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Significant Results of Research Reported at

Mechanical Division Meeting

Revised passenger-car axle design increases strength at wheel seat from 60 to 80 per cent—Progress reported on caustic embrittlement research—Changes in the loading rules to be adopted without submission to letter ballot

F. W. Hankins, Chairman

W. H. Flynn,
Chairman elect

V. R. Hawthorne,
Secretary

THE results of two important research projects in which the Mechanical Division is directly interested were reported at the eighteenth annual meeting of the Mechanical Division of the Association of American Railroads which was held in the South Ballroom of the Hotel Stevens, Chicago, June 27 and 28. Dr. W. C. Schroeder, senior chemical engineer, Eastern Experiment Station, Bureau of Mines, College Park, Md., presented a report, of which he and A. A. Berk, assistant chemist, Eastern Experiment Station of the Bureau of Mines, and R. A. O'Brien, assistant metallurgist, Joint Research Committee on Boiler Feedwater Studies, attached to the Eastern Experiment Station, were joint authors. This report brings up to date the results of the research supported jointly by the Association of American Railroads and five other organizations. New designs for passenger-car axles were presented for adoption by the Car Construction Committee. These designs were developed as a direct result of the laboratory studies which have been conducted for the Mechanical Division during the past two and one half years in the Axle Research Laboratory at the Timken Roller Bearing Company.

During the opening session addresses were delivered by C. H. Buford, vice-president, Operations and Mainte-

nance Department, A. A. R., and by F. W. Hankins, assistant to vice-president and chief of motive power, Pennsylvania, who also presided, as chairman of the Mechanical Division. Other addresses were delivered during the meeting by W. J. Patterson, member, Interstate Commerce Commission, and by J. M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission.

Following the addresses and the usual opening business, the General Committee reviewed its actions since the last annual meeting at New York in June, 1939. The committee reported that the membership of the Division at the present time includes 220 railway systems, full members of the Association of American Railroads, and 182 railways, associate members of the A. A. R., and that these railroads, members and associate members of the A. A. R. have appointed 827 representatives in the Mechanical Division. There are in addition, 564 affiliated and 428 life members in the Division.

Above:
D. S. Ellis

Right:
O. A. Garber

Lower right:
A. G. Christy

Below:
A. L. Ralston

In referring to the work of the Committee on Loading Rules, the General Committee asked for a resolution to approve its recommendation that new and revised loading rules hereafter be approved by viva voce or rising vote of representatives attending the annual meeting or by the General Committee between member meetings without the necessity of letter ballot. The committee pointed out that most changes in these rules are only recommended following extensive experimental shipments and approval or acceptance by the shippers, and that the shippers are demanding that the approval of new rules be expedited so that they can be placed in effect more promptly.

Above:
J. Purcell

Left:
R. G. Henley

Lower left:
H. B. Bowen

Below:
E. B. Hall

The committee reminded the member roads that as of December 31, 1939, 293,473 railroad owned and 24,621 private-line cars, or a total of 318,094 interchange freight cars, or 15.4 per cent, were equipped with AB brakes. Under date of March 20, 1940, the committee reported that a circular letter had been sent to all car owners asking advice as to what, if any, program had

been instituted to comply with the provisions of Interchange Rule 3, section (a), paragraph (4), by January 1, 1945.

The General Committee cited the action taken to provide for the home movement of cars equipped with arch-bar trucks after December 1, 1941, and then called attention to the adoption by letter ballot in February of a modified paragraph (4), section (t), Interchange Rule 3 to prohibit acceptance of cars equipped with arch-bar trucks in interchange, effective July 1, 1940. The modified rule is now published in Supplement No. 1 to the current rules of interchange issued in March, 1940.

Arrangement is being developed by the General Committee to provide dies for the manufacture of parts for the A. A. R. design of auto deck, and that when this arrangement is completed, members will be advised by circular.

Following the presentation of the General Committee report, a resolution embodying the recommendations of the General Committee with respect to the approval of the Loading Rules without letter ballot was adopted and the actions of the committee since the last meeting approved.

Above:
George McCormick

Left:
H. H. Urbach

At the opening of Friday morning's session two educational films were shown to the Mechanical Division by a representative of the United States Secret Service, Treasury Department. The first recounted the process of the manufacture of paper money and United States bonds, showing the various steps in the processes of engraving, printing, inspection, sorting and shipping. The second, entitled "Know Your Money," described the various kinds of paper money and their outstanding characteristics, by the comparison of which with counterfeit money the spuriousness of the latter is most readily detectable.

Election of Officers

The following candidates proposed by the Nominating Committee were elected as officers and members of the General Committee: W. H. Flynn, general superintendent motive power and rolling stock, New York Central, chairman (2-year term); R. G. Henley, superintendent motive power, Norfolk & Western, vice-chairman (2-year term); members of the General Committee (2-year term): F. W. Hankins, assistant vice-president-chief motive power, Pennsylvania; D. S. Ellis, chief mechanical officer, Chesapeake & Ohio; O. A. Garber, chief mechanical officer, Missouri Pacific; J. Purcell, assistant to vice-president, Atchison, Topeka & Santa Fe; A. L. Ralston, general mechanical superintendent, New York, New Haven & Hartford; and G. C. Christy, general superintendent of equipment, Illinois Central.

Address by C. H. Buford

In opening his address Mr. Buford expressed his pleasure at appearing before the Mechanical Division and continued in part as follows:

The railroads today constitute one of the first lines of defense of the country. Due to the splendid work of standardization of equipment and operating methods which has been carried on by the various railroad departments, the railroads were never in better shape to face such a task than they are today.

Above:
Otto Jabelmann

Right:
W. I. Cantley,
Mechanical engineer

The early founders of your Association realized the importance of exact information that could be obtained only through tests conducted under careful supervision, which is sometimes designated as applied research. In looking through the file of your proceedings, we find that as far back as 1875, you were engaged in testing practically of the various parts of cars and locomotives. In a great deal of this work, laboratories were utilized much as they are today, including those of Stevens Institute of Technology, Purdue University, and the laboratories of a number of railroads and railway equipment companies. Then, as now, the various groups of industries supplying materials and equipment to the railroads cooperated wholeheartedly in this work.

In more recent years, your division has conducted extensive research and tests on such important subjects as air brakes, freight car trucks designed for high-speed service, condensation in freight cars, draft gears, spring snubbers, etc. At the present time, you are making extensive tests of passenger car axles, and at this meeting,

as a result of this research, you are recommending the adoption of modified design for passenger car axles for high-speed service.

Research Points the Way to Further Improvements in Railroad Equipment

These tests and this research point the way to further advances in the art of design of railroad equipment to meet conditions which are becoming more and more exacting. Much credit also belongs to the manufacturers of materials and equipment which the railroads use. With your cooperation, these companies are continually experimenting in their shops and laboratories with improved methods, materials and equipment which are perfected for use.

There must be no letup in your program of advancement in knowledge and development. If the railroads are to continue to fulfill their carrier obligations and be able to expand and improve their services to meet changing conditions, you must continue the vigorous and courageous exploration of all possible means to increase the efficiency, dependability, safety and economy of the railroad service as it is affected by equipment and the facilities under your jurisdiction.

Another point I want to mention is the need for prompt prosecution of any test or research problem under consideration. I refer not only to problems that are strictly mechanical, but also to those that have to be worked out jointly with other divisions or sections of the Association. I note that at this meeting, your committees are presenting completed reports on a number of important matters, along with progress reports on other subjects. I believe the position of Mechanical Engineer which was established on the recommendation of your General Committee about two and a half years ago has contributed to the prompt handling of many matters.

Railroads Essential to National Defense

I have said that the railroads constitute one of the first lines of defense of this country. The railroads have always recognized that fact, and even through the depression years have been working with the War Planning Board to determine the means and methods required to best serve the nation in the event of a grave emergency.

Now that our country is starting on a large and much-needed program of national defense, there are some who question the ability of the railroads to handle whatever increase in business may materialize. No one knows what the increase will be, but there are those who make a guess, based on some business index they select. They then count the number of locomotives and cars owned by the railroads, find out the age of the units of equipment, and, using their guess as to the prospective traffic to be moved, tell us how many thousand locomotives and how many hundred thousand cars the railroads should buy.

Some of this advice comes to us from those who have had no railroad experience except such as they get from a study of statistics, and even then they have not considered or do not know how to evaluate all of the statistics bearing on the subject.

It is generally accepted that if we need legal advice, we should go to a lawyer, and if we need medical advice, we should go to a doctor. It follows that if information is wanted about railroads, the railroads themselves should furnish it. The Association of American Railroads, which represents practically all of the Class I railroads in the United States, has just completed a study of the equipment situation on its member lines, and I want to give you the results of that study. I do this because some of you here today are interested in industries which furnish cars and locomotives to the railroads, and are probably wondering if there is immediate prospect for large orders for rolling stock.

Railroads Equipped to Handle Expected Traffic Peak This Fall

As of June 1st this year, the railroads had 35,784 more serviceable cars than they had in October, 1939, at which time the average loading was 843,736 cars per week with a peak of 861,000 cars in the week ending October 21. With the new cars on order and the number that can be placed in service by repairs, we will have sufficient equipment to handle a much higher peak load this fall than was handled in 1939. From a careful study of our loading record during the World War and since that time, we can find no basis for an estimated loading at the peak this year that will be in excess of what the railroads can handle.

Unless there is a real need for additional equipment, or unless there is some economy to be gained by adding cars and locomotives, there is no reason why railroads should buy them or should even put money into repairing bad-order equipment. The railroads do not now need more equipment than they have. The only reason, therefore, that railroads might be expected to purchase more equipment would be to reduce operating costs. Wherever opportunities of that sort exist, and especially considering low interest rates and higher prices for the scrap in the old unit, railroads might be interested in additional equipment.

Chairman Hankins' Address

Chairman Hankins reviewed some of the important matters which have come up since the last annual meeting and commented on some of the outstanding subjects which would be brought before the members of the division in committee reports.

The improvement in general business conditions during the past year has imposed additional problems. Forecasts of the Shippers' Regional Advisory Boards indicates a further considerable increase in business for the railroads for the year 1940. With the decrease in ownership of freight cars during the past ten years, it is important that bad order cars be kept at the minimum and that serviceable cars be utilized to the greatest extent possible. By reason of improved materials and methods of construction and repairs, a lesser number of freight cars of today can perform more transportation service than a greater number of cars of older types. Improved motive power and transportation methods provide also for quicker turn-around of freight cars, resulting in the cars handling more loads and making greater revenue mileage a year.

Much is yet to be accomplished in improving the motive power and equipment. The arch-bar truck has been eliminated from interchange, but improvement in trucks is imperative to enable freight to be handled more expeditiously and without damage. As conditions permit, application should be expedited of the improved freight brake and certified draft gear to improve train handling and lessen damage to lading and equipment with the quickening of train schedules.

During the past year, upon recommendation of your General Committee, tests were conducted of trucks designed for high-speed freight service. Report of these tests will make available to truck manufacturers information and data upon which to base their designs of trucks

for high-speed freight service, indicating the direction in which they should be developed.

The research program of this division for passenger car axles has resulted in recommendation by the Committee on Car Construction for adoption of new design of axle for the various journal sizes for new passenger cars. Further research is being conducted to develop the best specification for material for axles for heavy-duty service. This will be prosecuted so that final recommendation will be available early next year.

Complaints have been made to the General Committee that excessive repairs are being made to foreign cars—especially to empty cars that are delivered to owners by direct connection immediately after completion of repairs. The member roads were requested by your General Committee to report their bills against foreign and private car lines on a car-day basis for a period of eighteen months. After analysis of these reports, special investigations were made where billing was out of line with the average. As a result, the Arbitration and Price Committees are reviewing all labor and material allowances in the Interchange Rules, to the end that such allowances will be established so as to reimburse the repairing line for labor, material and overhead expense incurred in repairing foreign cars and contain no element of profit. While the survey is not yet completed, the Price Committee in its report for this year is recommending such readjustment in material prices and labor allowances as is indicated to be necessary. The Arbitration Committee is recommending revision of Interchange Rule No. 1 to make clear the intent that repairs should be made by the car owner insofar as may be practicable, and that repairs to foreign cars shall be confined to the minimum necessary for safety of operation.

Shippers of heavy freight—sheet steel in bundles, coiled strips, etc.—have adopted a practice of loading these commodities in box cars by the use of lift-truck tractors that impose loads on floors of box cars at the doorway that were never contemplated when the present car designs were prepared and adopted. The Car Construction Committee is recommending reinforcement for car floors used in such service. The Car Construction Committee recommends also a standard contour for passenger cars.

Both of these recommendations should have your careful consideration.

The Committee on Couplers and Draft Gears during the past year has carefully reviewed the experience of the member roads with the tight lock coupler that was adopted as Recommended Practice in 1937 and last revised in 1939. As a result of this study, Circular No. DV.-977 was issued under date of April 3, 1940, containing instructions for making adjustments to improve lock anti-creep. On the same date, there was issued Circular No. D. V.-976 containing revised instructions governing operation, inspection and maintenance of tight-lock couplers.

The report of the Committee on Wheels, which will be discussed at this meeting, contains important recommendations for revision and improvement of specifications for cast iron wheels and the adoption of specifications for heat-treated wrought steel wheels. This report is commended to your careful and thoughtful consideration.

The report of the Committee on Locomotive Construction contains much useful information. This committee reports on a number of important phases of locomotive design.

All of the committee reports that will be discussed at this meeting represent careful and painstaking effort. It has been our purpose not to point out the work of any particular committee, but to refer to some of the important matters covered in this year's reports and to direct your attention to all of the reports that will come before you for your discussion and disposition.

Commissioner Patterson Speaks

W. J. Patterson, member, Interstate Commerce Commission, in speaking briefly to the opening session of the Mechanical Division, said that his remarks would largely be related to matters with which he was formerly deeply concerned as director of the Bureau of Safety, since his work as commissioner had not been closely related to matters with which the members of the Mechanical Division are concerned. He expressed the hope that by July 1 the arch-bar truck would be completely extinct. He also emphasized the need for action in carrying out the program of replacing the old freight-car brakes with the improved type brake. The development of brakes for operation in high-speed service, he said, had been more rapid in passenger service than in freight. He cited as evidence of the need for a higher braking ratio on heavily loaded cars, a case in which a freight train approaching a junction at a relatively slow speed overran the switch and was sideswiped by a train on the main track. Investigation, he said, would probably show that the braking ratio on this train was down around 16 per cent, which he considers to be entirely too low.

Mr. Patterson commented particularly with respect to free slack in freight-car couplers. He said that he based his opinion on the fact that fewer break-in-twos are now occurring as the result of free slack or of the dropping of couplers.

Progress was being made, Mr. Patterson said, in the design of lightweight passenger rolling stock to insure safety of the new designs. He referred to the development of equipment and facilities for the testing of full-size samples of new designs and recommended that no new designs be established without a sample first being subjected to a suitable test. He expressed his confidence in the tight-lock coupler designed to take a vertical load of 100,000 to 150,000 lb. as an important safety device in passenger service. In case of derailment or wreck from other causes, such couplers tend to keep the train in line and thus avoid the unpredictable type of structural failures which may occur when the cars separate and are thrown violently out of line.

Mr. Patterson emphasized the importance of terminal inspection of air brakes, which some railroads are inclined to neglect, in insuring the control of trains under all conditions on the road. He also reminded the railroads that the constitutionality of the stoker order has been established by the Federal Court of the United States, and that the Interstate Commerce Commission has no authority to make any exceptions to the application of the order unless the applicant is clearly outside its scope.

Remarks by Director Hall

J. M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission, called upon by Chairman Hankins, reiterated Commissioner Patterson's caution concerning the holding off too long on the equipment of locomotives with stokers. He reminded the members that the stoker order requires equipment of 20 per cent of the locomotives requiring stokers each year

during the five-year period within which the work must be completed.

Mr. Hall also suggested that it would be well for the roads not to get caught on the last year within which the equipment of locomotives with power reverse gears must be completed with too large a part of the program still ahead of them.

Some roads, he said, are reluctant to equip their steam-locomotive water glasses with quick-closing valves. In such cases, he said, it was the practice of some enginemen after testing the glass not to open the valves wide but merely to crack them in order that they may be closed quickly and thus guard the men against burns, should the glass break. This, he said, is contrary to good practice in the matter of assuring free openings between the boiler and the water glass, and may result in false water indication.

In commenting on previous remarks concerning the need for more equipment, he suggested that things are moving pretty fast in Europe and that one is not likely to be given much time to meet changing conditions. He cited the case of one important road on which 27.6 per cent of the locomotives are now in or awaiting shop. This he does not consider particularly safe preparation for the future, whatever the situation may be as to the adequacy of the actual number of cars and locomotives owned.

In commenting on the inspection of locomotives other than steam, Mr. Hall said that there was no rule as to exactly what employee should make the inspection of these locomotives, so long as he was competent. He referred to the desire of some roads to have inspections done by the engineman since by this means it becomes unnecessary to bring the locomotive into the engine terminal. This, he said, is not objected to, but the inspection must be made. Seat-box inspections by the engineer are utterly inadequate to locate and report such defects as cracked wheel flanges, checked spring bands, cracks in the bolsters and other similar defects.

Lubrication of Cars and Locomotives

The committee held two meetings during the past year devoted to the questions of business held over from previous years or new business referred to it through the office of the secretary, or former chairman, E. L. Johnson. Since no new subjects pertaining to locomotive lubrication have come up during the year, our report this year covers general subjects relating to the lubrication of car equipment only.

Dust Guards

Last year's report included suggested revision of the current specifications M-903-34 recommended by the committee to be circularized among the members of the Association for comment. During the year suggestions and criticisms have been received and samples of dust guards from a number of manufacturers accumulated by a sub-committee who report progress only for this year. The sub-committee is undertaking further study and tests with a view of developing recommendations for a revision of specifications M-903 to include some limitations covering materials and workmanship. The dimensional modifications proposed during 1938-1939 of the upper portion of the guards to prevent forcing out the top dust-guard well wedges has been approved by the association during the year.

Interchange Rule No. 66

During the year a number of subjects relating to proposed changes or additions to clauses of Rule No. 66 were referred to and handled by the committee as follows:

Question of owners' vs. handling-line responsibility for imbedded waste grabs in journal bearings.

Action: The committee is unanimously of the opinion that Section (j) should not be amended to include imbedded waste grab in journal bearing as owners' responsibility.

Question of condemning limit for end wear of freight-car journal bearings as applied to bearings originally applied shorter than standard.

Action: The interpretation by the majority of the committee members was that paragraph (j-2) covers end wear based on the standard journal-bearing length and that no change is necessary to apply the limits of end wear as therein stated to worn bearings originally applied having length shorter than standard.

Proposed that free oiling journal boxes—freight equipment in interchange be made mandatory.

Action: The action of the committee based on the majority opinion of the members was that it would not be desirable to incorporate in the Rules a requirement to cover the use of free oil, but that its use be left as at present to the judgment of the individual road.

Standard method of packing journal boxes—present "one-piece" vs. proposed "roll method."

Action: The opinion of committee members was divided as between the two methods of packing boxes: both methods considered satisfactory. Tests are to be undertaken during the coming year by several members on their roads to develop facts based on comparative service performance. No definite recommendation for change from the present standard is made at this time.

Proposed setting up of labor price (Rule 107) to cover trimming over-run babbitt on journal bearings with "brass-trimming machines" at periodic re-packing periods required by Rule No. 66.

Action: After full discussion of the proposition involved in the use of the brass trimming machines and the practice of trimming the over-run lining of bearings otherwise serviceable and replacing them on the same journals for further service, the committee does not recommend the practice of trimming journal bearings on cars of foreign ownership.

Joint Sub-Committee on Journal Boxes and Contained Parts

This joint sub-committee having membership from the Committee on Car Construction and the Committee on Lubrication of Cars and Locomotives held two meetings during the year. The subjects handled, as they had bearing on the question of lubrication, included: (1) Question of dimensional changes in journal bearing design as related to the over-heating of 6½-in. by 12-in. bearings in locomotive tender service; (2) question of modification in the roof in the inside of journal boxes A, B, C, D, E, and F, to provide better contact surface between roof and wedge and thereby permit of proper movement and alignment to reduce bearing over-heatings; (3) question of waste-retaining ribs in journal boxes to prevent packing rolling and over-heatings due to strands getting between journals and bearings; and, (4) consideration of the question of dimensional modifications and reducing manufacturing and running tolerances of parts comprising the journal box assembly with a view of better control of lateral and a consequent reduction in over-heatings attributable to the lubrication of parts taking the lateral thrust.

Inasmuch as the final action on the above questions all involve dimensional changes and the design of parts, they come properly under the jurisdiction of the Committee on Car Construction and will not, therefore, be other than referred to in this report.

Report of Joint Sub-Committee on Journal-Box Lubricating Materials

Your joint sub-committee, since its authorization on May 27, 1936, has carried out studies of journal-box lubricating materials and has made annual reports to you with such suggestions for revision of the oil, waste, and packing specifications as were deemed justified by the information developed through surveys and tests carried out each year. A brief review of the work carried out during the past four years is summarized in this year's report.

1936-1938 Survey of Renovated Oils, Wastes and Packings

Information pertaining to facilities and methods of renovation and samples of oils, wastes, and packings representing renovated

journal box materials were secured from each of the member roads represented on the 1936 Specifications and Lubrication Committees, and the Southern Pacific. Samples representing 17 oils, 26 wastes, and 22 saturated packings were received from the Atchison, Topeka & Santa Fe; Baltimore & Ohio; Chesapeake & Ohio; Chicago, Burlington & Quincy; Chicago, Milwaukee, St. Paul & Pacific; Chicago & North Western; Chicago, Rock Island & Pacific; Delaware & Hudson; Illinois Central; Missouri Pacific; New York Central; New York, New Haven & Hartford; Northern Pacific; Pennsylvania; Southern Pacific, and Southern.

The samples were furnished in triplicate and analyzed in the A. T. & S. F., Mo. Pac. and N. Y. C. laboratories to determine the values of 14 items using methods commonly accepted as standard, previously agreed to or developed during the progress of the work. Some study of special apparatus for the analysis of saturated packing was made, but abandoned in favor of the method finally recommended. Detailed results of this survey were reported to the membership of the two committees under date of May 22, 1938, with recommendations for revision of the renovated car-oil specification as M-904-38, and a new specification for renovated journal-box waste and packing as M-910-38.

These specifications were recommended by the committees for circularization among the members of the Association as information, and were published in Circular No. DV-938, dated Chicago, August 26, 1938. Comments and criticisms received from the member roads through the secretary's office were studied at a meeting of your joint sub-committee on December 19, 1938.

The classification of the comments on the suggested revision of specifications M-904-38 for renovated car oil showed:

Roads in favor, or in favor with minor suggested modifications	28
Roads in favor in general, but suggesting deletions, changes, or additions	14
Roads against, or favoring retention of present specification M-904-36	15
Total number of roads making comments	57

The classification of the comments on the suggested new specifications M-910-38 for renovated journal-box waste and packing showed:

Roads in favor, or in favor with minor suggested modifications	39
Roads in favor in general, but suggesting deletions, changes, or additions	9
Roads against, or favoring the current specification (Rule 66)	8
Total number of roads making comments	56

Based on study of the comments and criticism received from the membership of the association, the specifications were revised and resubmitted to the members of the committees under date of December 22, 1938, as M-904-39, and M-910-39.

Further Investigations of Renovated Car Oil

The joint sub-committee's draft of specifications M-910-39 was approved by Specifications Committee at a meeting held January 11-12, 1939, but action on specifications M-904 was deferred and further investigation of "precipitants" and a study of the method of "ash" determination of renovated car oils in the laboratories of all members was authorized. The joint sub-committee submitted tables with this report setting forth the results of investigations of precipitant and ash determinations of renovated car oils conducted independently by each member of the Specifications Committee.

The General Committee in New York on June 27, 1939, deleted specifications M-904-39 from the 1939 report of the Specifications Committee and referred it back to the committee for further study and analysis. In accordance with this action, the joint sub-committee made a survey of the renovated car oils actually used by seven railroads and included in this report tables tabulating the check analyses by several railroad laboratories of duplicate samples of these oils.

A revision of the specifications for renovated car oil, suggested by the joint sub-committee with a recommendation for submission by letter ballot as specifications M-904-40, was attached to this report. In Section 5 (Properties and Tests) of the revised specifications were two foot-notes. The first pointed out that, because of the variations in solvent action with respect to tarry matter of A. S. T. M. precipitation naphthas from different sources and to assure the agreement in the results obtained by different laboratories, it is desirable that the reagent be obtained from one source, the Standard Oil Company of Indiana (Whiting Refineries). The second called attention to the fact that the difference, as between laboratories, in the determination of the "precipitation number" of a renovated car oil by A. S. T. M. method D-91 can be 0.05 per cent at the 0.25 per cent maximum value specified and, therefore, a precipitation-number determination of 0.30 per cent for any given oil would not be cause for rejection under these specifications.

Specifications M-910: Renovated Journal-Box Packing

Your joint sub-committee has carried out your instructions to consider the matter of placing some arithmetical limitation on the percentage of "short ends" permissible in renovated journal-box packing as suggested by G. W. Ditmore, a former chairman of the Lubrication Committee, in his communication of March 4 to the secretary, and referred to the committees with his file ST-10-910 of March 8, 1940.

The suggestion of the joint sub-committee for a revision of specifications M-910 to meet Mr. Ditmore's objections as made in the preliminary draft of the 1940 annual report dated April 4, 1940, was approved at the meeting of the Lubrication Committee on April 18, but, after consideration of reports of proof checks of method and determination of the actual percentage of "short ends" in renovated packings by several members of the Specifications Committee, as suggested in the chairman's letter of April 4, to the memberships, the revision of specifications M-910 to include the proposed limit for "short ends" was not approved and will not, therefore, be recommended to the association membership.

The report as a whole was signed by J. R. Jackson (chairman), engineer of tests, Mo. Pac.; P. Maddox, superintendent car department, C. & O.; A. J. Pichetto, general airbrake engineer, Illinois Central; L. B. Jones, engineer of tests, Pennsylvania; W. G. Aten, mechanical inspector in charge of lubricating matters, C. B. & Q.; J. Mattise, general air-brake instructor, C. & N. W., and J. W. Hergenhan, assistant engineer, test department, N. Y. C.

In presenting the report, Chairman Jackson called the attention of the members to the fact that the proposed revision of Specification M904-40, Exhibit "M," in the report, had been withdrawn by the committee for further study.

Report on Wheels

During the year there have been two meetings of the Wheel Committee in addition to meetings held by sub-committees detailed on various special subjects. As a result of the year's work your committee submits the following report:

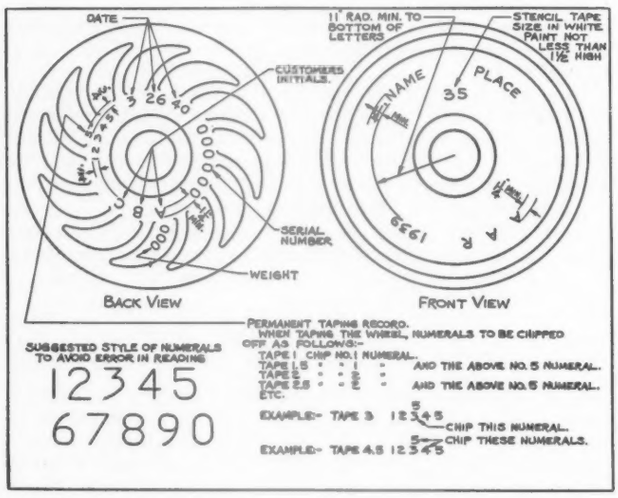
Cast Iron Wheels

In the 1939 Report of the Wheel Committee, Circular DV-959, a revision of the Cast Iron Wheel Specification M-403-39 was presented for consideration, the revised section of the specifications being attached as Appendix A. (Not included in the present abstract of the committee report.) It is now the unanimous opinion of the Wheel Committee that these revised specifications be advanced to standard with modifications as indicated below:

Sec. I. Manufacture

Par. 4. Marking—Revise to read: "All wheels shall be marked and numbered consecutively in accordance with instructions issued by the purchaser.

"All wheels shall bear the initials of the purchaser, weight of wheel, *serial number, tape indicating numerals,* and month, day and year when made cast on the back of the plate as shown in *Fig. 4.* All wheels shall have the name of the manufacturer and place cast on the front of the plate. Wheel numbers once rejected shall remain unfilled. All wheels conforming to require-



Marking required to be cast on the front and back of chilled-iron car wheels

ments of these specifications shall have plainly marked on the front of plate 'A. A. R. *1940*'."

In the foregoing revision, provision is made for applying the purchaser's serial number and the indicating tape numerals on the back of the plate. In the original design of the bracketed type, single plate wheel, this could not be done on account of the length of the brackets. The manufacturers have shortened the brackets and it is now possible to add this marking to the back of the plate.

Sec. III. Design, Dimensions and Weights

Par. 6.—Identify Par. (d) as Par. (e) and insert new Par. (d) to read as follows: *All ground wheels shall be stenciled on front and back of plate with tape size as measured after grinding for use in mating wheels for mounting. Cast numerals shall be chipped to represent "as cast" tape size.*

In Tables I, II and III, change maximum weight from 825 lb. to *850* lbs. In Table I, change minimum weight from 815 lb. to *840* lb. The reason for this recommended change in weights is, the wheels as now manufactured are weighing around 850 lb.

Sec. V. Inspection and Rejection

Par. 10.—Insert new paragraph designated as (e-4) to read as follows: *Wheels checked for out-of-round, where there is more than 1/32 in. space between ring gage and tread may be ground to conform to the specifications. Such wheels shall not be reduced more than two tape sizes and the taper 1 in 20 shall be maintained,* and then change present paragraph (e-4) to (e-5).

Bracketed Cored Hub Wheels

In the committee's 1938 report, reference was made to authority having been granted the Association of Manufacturers of Chilled Car Wheels to manufacture 10,695 lb. bracketed type, cored hub wheels for use on cars of 100,000-lb. capacity.

In conformance with the above authority the cast iron wheel manufacturers have made 3,200 wheels, distributed as follows: 800—under lightweight welded cars for the Pullman-Standard Car Manufacturing Company; 800—under 50-ton cars for the C. B. & Q.; 800—under 40-ton refrigerator cars for the General American Transportation Corporation; 800—under lightweight cars for Pullman-Standard.

There still remain unfilled on this authority for 10,000 wheels, 6,800 bracketed-type, cored-hub wheels of 695-lb. weight.

The Association of Manufacturers of Chilled Car Wheels requests that it be permitted to manufacture the remaining 6,800 wheels on this authority in the bracketed, cored hub type of any standard weight. This request is made that more general information may be obtained from this type of wheel when applied to various classes of service.

Your committee is favorable to this request, but if granted, it should be with the understanding that the manufacturers cast immediately under the AAR-X in clearly discernible letters the words "cored-hub." This requirement is recommended in order to readily identify the cored hub wheels and thus simplify the handling of such wheels in Interchange. These wheels shall conform to the requirements under which the authority was originally granted.

Cored Hub—Axle Strength

In discussing cast iron wheels with cored hubs in the 1938 report, mention was made of two conditions that might react unsatisfactorily to the use of this design, namely, the effect the cored openings in the hub surface might have upon obtaining a smoothly-machined surface in the bore of the wheel and the effect on the unsupported section of the hub might have upon the strength of the axle.

It has been reported that no serious difficulties have been encountered in boring the cored-hub wheels, but information is still lacking in regard to the effect the cored hub may have upon the strength of the axle. The Association of Manufacturers of Chilled Car Wheels advise it has a program of laboratory tests under way which tests are of a preliminary nature, but designed to develop information along the line of axle strength. It is anticipated that these preliminary tests will be supplemented with other laboratory tests using full size axles.

Multiple-Wear Wrought Steel Wheels

Referred to in and appended to the 1939 report was a Tentative Specification for Heat-Treated Multiple-Wear Wrought Carbon Steel Wheels for Locomotives, Locomotive Tenders and Passenger Cars. The membership has had the opportunity to apply the specification throughout the year and while it has been closely followed by some roads, others, due to the specifications not being published in the Manual of Standards, have overlooked it.

So far, no criticism has been registered against this specification. It is the opinion of your committee that under Sec. II—Chemical Properties and Tests—Par. 5—the maximum carbon content in Class-C wheels be revised from 0.80 to to *0.77 per cent* and under Sec. II—Par. 7 (b) a maximum hardness be established for Class-C wheels. This maximum hardness to be *363 BHN.*

With the above mentioned revisions it is the recommendation of the committee that the tentative specifications for heat-treated multiple-wear wrought carbon steel wheels for locomotives, locomotive tenders and passenger cars be submitted to letter ballot for advancement to standard practice. These specifications revised in accordance with the above are reprinted as Appendix B (not included in this abstract of the committee report).

Multiple-wear wrought steel wheel specifications M-107-37 and the tentative specifications covering multiple-wear wrought carbon steel wheels, in the section referring to "Scope," limits the application of the specifications to 38-in. diameter wheels. The use of wrought steel wheels in the process of locomotive development has created a demand for wrought steel wheels exceeding the present 38-in. diameter limit and recommendations have been made that the item "Scope" be revised at this time. At the time this report was prepared the committee had not received suggestions from the Locomotive Construction Committee as to what its wheel requirements may be and it was considered that revision of the "Scope" section of the specifications and associated items be deferred for consideration by the Wheel Committee during the coming year.

Shelling of Wrought Steel Wheels

The shelling of wrought steel wheels and tires represents a condition that is most destructive to the wheel and tire material. The shelled condition not only is objectionable from the standpoint of riding qualities, but the tendency of this condition to penetrate deeply into the material makes it especially destructive to the potential service of the wheel or tire where it occurs. Various theories as to the cause of tread material shelling have been advanced. The generally accepted theory is discussed in a recent booklet prepared by the Technical Board of Wrought Steel Wheel Industry. While the theory upon which this booklet is based is more or less technical the author in dealing with the subject has avoided as much as possible the technical side of the subject and treated it in such a manner as to be readily comprehended without the reader having to delve into the mathematics involved. As the subject treated in this booklet is so closely related to one of the major problems in wheel and tire

service your committee requested the privilege of making the contents a portion of this year's report, available as Appendix C (not included in this abstract of the committee report).

[This discussion of the shelling of wrought steel wheels, prepared by the Technical Board of the Wrought Steel Wheel Industry and presented as Appendix C, is an extension of notes included in the 1939 annual report. It is a comprehensive and easily followed analysis of conditions which lead to shelling and methods necessary for its prevention. The wheel is studied as an engineering structure and an examination made of (1) stresses under various load conditions, (2) the metal strength and (3) the application of (1) and (2) to the selection of proper wheel types for various service requirements. Appendix C describes methods of computing tread stresses, discusses the mechanical properties of wheel steel, and the effect of rail and wheel tread contours on maximum shear stress. It concludes with the calculations necessary in developing a series of charts giving surface stresses in compression and maximum shear stresses for varying wheel loads and wheel diameters.—Editor.]

Cast Steel and Spun Steel Wheels

The status of the cast steel wheel industry is somewhat uncertain and while there are a number of cast steel wheels of the one-wear type in service, information reaching your committee is to the effect that neither the one-wear nor the multiple-wear wheels are, at the present time, in production.

The spun steel wheel industry is still actively engaged in efforts to produce a multiple-wear wheel capable of meeting exacting service conditions. In line with this policy the manufacturers have placed small groups of spun wheels under conditions where their service properties can be best developed and encouraging results are reported.

It has been suggested that attention be given to a revision of interpretations under Rule 98 referring particularly to answers to Questions 5 and 6 under this rule. Your committee recommends that under the first line of answer to Question 5 the words "one-wear wrought steel" be omitted and the "or" inserted between the words "cast iron" and "cast steel." With this change the committee sees no occasion for any revision of answer to Question 6.

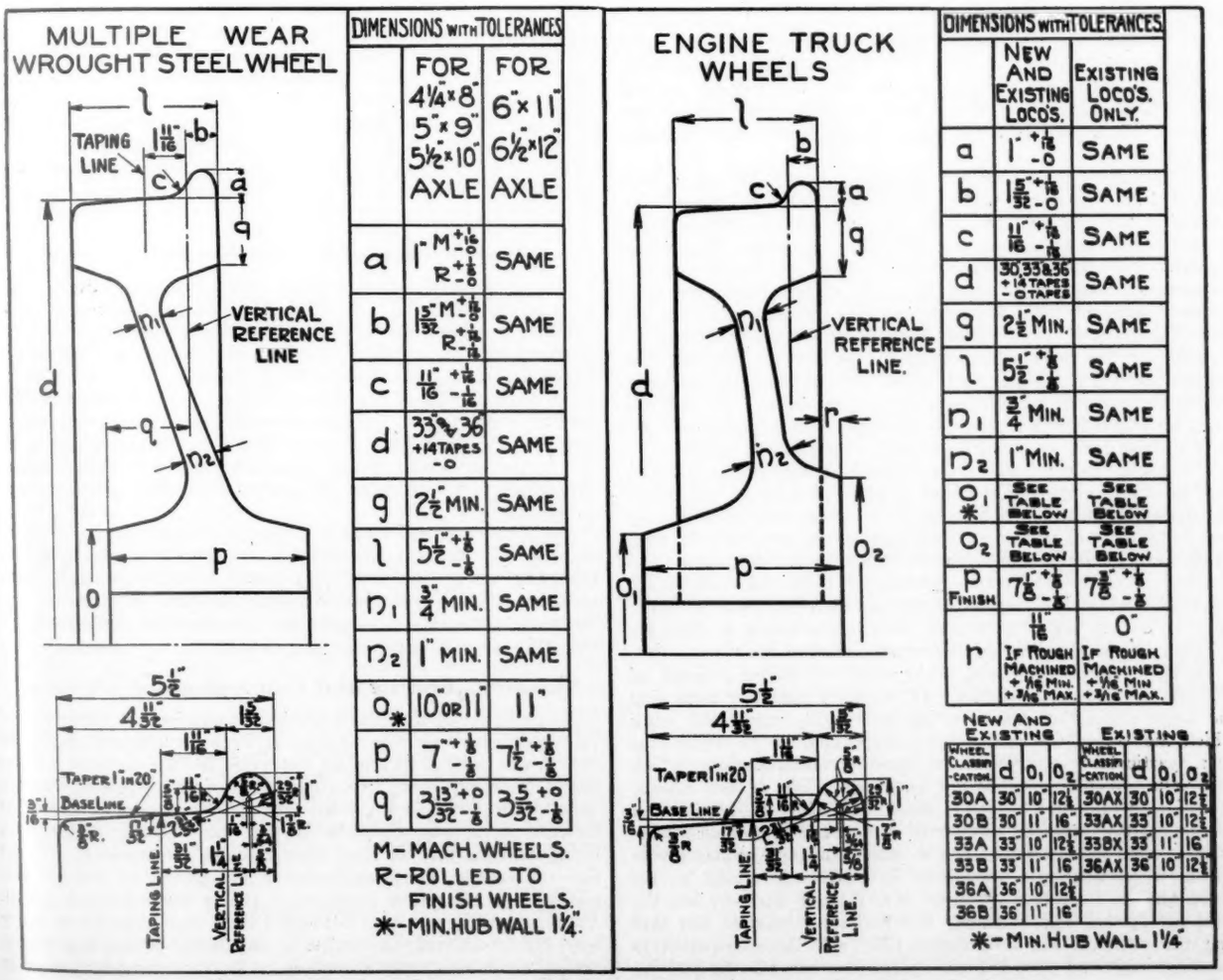
Cast Steel Wheel—Second-Hand Value

It has been brought to the attention of the committee that railroads handling cars equipped with one-wear cast steel wheels are coming in possession of second-hand wheels of this class with little or no opportunity for disposing of them. It appears that the one-wear cast steel wheel is no longer produced and its use is being discontinued by the railroads that formerly patronized it, it has also been stated that some of the railroads that formerly used one-wear cast steel wheels are substituting cast iron wheels and removing the cast steel wheel stenciling from the cars, thus making the cast iron wheel standard to the car. This practice is further limiting the opportunity for the disposal of accumulated second-hand cast steel wheels.

It is apparent that the chance for disposal of second-hand cast steel wheels accumulated in interchange is being more and more limited and your committee recommends that some protection should be afforded the railroads coming in possession of these wheels, through a revision of the second-hand value of one-wear cast steel wheels, making their values comparable with second-hand cast iron wheels of the same capacity, then revising the rules to permit one-wear cast steel wheels to be substituted for cast iron wheels at the second-hand value of cast iron wheels.

Wheel-Shop Practices

In order to better meet more exacting service conditions care-



DIMENSIONS WITH TOLERANCES

	FOR 4¼"×8" 5"×9" 5½"×10" AXLE	FOR 6"×11" 6½"×12" AXLE
a	1" M +1/16 −0 R +1/8 −0	SAME
b	1 5/32" M +1/8 −0 R +1/16 −1/16	SAME
c	11/16" +1/16 −1/16	SAME
d	33" & 36" +14 TAPES −0	SAME
q	2½" MIN.	SAME
l	5½" +1/8 −1/8	SAME
n1	¾" MIN.	SAME
n2	1" MIN.	SAME
o*	10" OR 11"	11"
p	7" +1/8 −1/8	7½" +1/8 −1/8
q	3 13/32" +0 −1/8	3 5/32" +0 −1/8

M—MACH. WHEELS.
R—ROLLED TO FINISH WHEELS.
*—MIN. HUB WALL 1¼".

DIMENSIONS WITH TOLERANCES

	NEW AND EXISTING LOCO'S.	EXISTING LOCO'S. ONLY.
a	1" +1/16 −0	SAME
b	1 5/32" +1/8 −0	SAME
c	11/16" +1/16 −1/16	SAME
d	30, 33 & 36 +14 TAPES −0 TAPES	SAME
q	2½" MIN.	SAME
l	5½" +1/8 −1/8	SAME
n1	¾" MIN.	SAME
n2	1" MIN.	SAME
o1*	SEE TABLE BELOW	SEE TABLE BELOW
o2	SEE TABLE BELOW	SEE TABLE BELOW
p FINISH	7⅛" +1/8 −1/8	7⅛" +1/8 −1/8
r	11/16" IF ROUGH MACHINED +1/16 MIN. +3/16 MAX.	0" IF ROUGH MACHINED +1/16 MIN +3/16 MAX.

NEW AND EXISTING WHEEL CLASSIFICATION	d	o1	o2	EXISTING WHEEL CLASSIFICATION	d	o1	o2
30A	30"	10"	12½"	30AX	30"	10"	12½"
30B	30"	11"	16"	33AX	33"	10"	12½"
33A	33"	10"	12½"	33BX	33"	11"	16"
33B	33"	11"	16"	36AX	36"	10"	12½"
36A	36"	10"	12½"				
36B	36"	11"	16"				

*—MIN. HUB WALL 1¼"

"Dimensions and tolerances of multiple-wear wrought-steel car and engine-truck wheels

ful consideration is being given to materials and designs in the construction of car equipment which includes both wheels and axles. In dealing with the question of wheels and axles another factor that is as equally important as material or design, is the manner in which these two units are combined, or the wheel-shop practices followed in mounting.

The unsatisfactory manner in which some wheels and axles have been mounted can be readily observed in practically any active wheel shop by noting the condition of wheel fits on the axles and the bore of wheels as disclosed when they are dismounted in connection with wheel-shop processes.

Again, your committee wishes to emphasize the importance of providing adequate wheel-shop machinery and then demanding closer observance of methods that will produce a greater degree of refinement in the preparation of wheels and axles for mounting.

The report was signed by H. W. Coddington (chairman), chief chemical and test engineer, N. & W.; D. Wood (vice-chairman), engineer tests, Sou. Pac.; E. E. Chapman, mechanical assistant, A. T. & S. Fe; W. R. Hedeman, engineer of tests, B. & O.; J. Matthes, chief car inspector, Wabash; A. M. Johnsen, engineer tests, Pullman Company; E. C. Hardy, assistant engineer, N. Y. C.; A. G. Hoppe, assistant mechanical engineer, C. M. St. P. & P.; H. H. Haupt, general superintendent motive power, Penn., and C. B. Bryant, engineer of tests, Southern.

Discussion

Following the presentation of the report by Chairman Coddington, F. J. Jumper, general mechanical engineer, Union Pacific, read a prepared discussion in which he described Union Pacific experience with thermal cracking or checking and shelling of wrought-steel wheels under the exceptionally severe conditions of modern high-speed passenger-train service. He attributed the difficulty largely to overheating of the wheels in heavy brake applications and the subsequent sudden cooling on the cold rails or by the application of snow or water. These difficulties have now been largely overcome by the use of heat-treated steel wheels with a carbon content ranging between .57 and .67, and a minimum Brinell hardness of 277. Mr. Jumper said that important factors in satisfactory wheel service and life include ground treads, brake rigging of proper design, square truck frames and journal boxes designed for free vertical movement without binding.

C. T. Ripley, chief engineer, Technical Board, Wrought-Steel Wheel Industry, complimented the committee on its report and said that the carrying out of its recommendations will promote safety, benefit shippers and save the railroads money. Both wheel manufacturers and the railroads must cooperate in effecting improvements necessary to meet the more difficult operating conditions attendant upon high speeds. Mr. Ripley said that research for wheel improvements must be continuous and that, on account of the increased severity of the service, the day has passed when any single steel wheel can be expected to meet satisfactorily the requirements in every class of service. Wheels must be selected with regard to the types best adapted for particular conditions, as pointed out in the committee's report.

Mr. Ripley paid tribute to the general ability, intelligence and loyalty of men employed in wheel shops and suggested that, when unsatisfactory wheel and axle work is discovered, it is usually due to the lack of proper shop equipment. In other words, with machining tolerances of .005 in. now being demanded and attained in wheel-shop work, micrometer tools and calipers are essential, and desired results cannot be expected even with the most competent and experienced wheel-shop forces if they are compelled to work with obsolete worn-out shop tools.

F. H. Hardin, president, Association of Manufacturers of Chilled Car Wheels, endorsed Mr. Ripley's comment regarding the large amount of intensive and thoroughly competent work which the Wheel Committee has incorporated in its report this year, particularly as relates to those recommendations which will assure increased reliability and longer life of car wheels. Mr. Hardin said that, owing to substantially higher freight-train speeds and the increased severity of operating requirements, carefully selected materials and fine workmanship are just as essential in wheel and axle assemblies in freight-car trucks as for those used in passenger service. Mr. Hardin also stressed the need for further improvements in wheel-shop practice and said that the railroads are cooperating fully with his association in securing improved service from chilled-iron car wheels.

There was some further discussion of the desired minimum carbon content in steel wheels used for high-speed passenger service and also the method of heat treating necessary to produce the best results.

The report was accepted and necessary items referred to letter ballot.

Report on Brakes and Brake Equipment

Since the last annual report there have been two meetings of the full committee and a number of sub-committee meetings covering investigation of various items under consideration, many of which are still incomplete, and we submit the following for your consideration at this time.

Air Hose Couplings

The question of suitable gages for checking used couplings, methods of reclaiming or servicing hose couplings, has been before us for some considerable time and while the solution may have appeared simple at first glance, it is not to be so readily solved. Much time has already been given it with considerable progress, and we hope to have definite recommendations to submit in the very near future.

Standard Brake Beams

In our report last year we promised you that our recommendations would be forthcoming in the very near future for a No. 3 or No. 18 brake beam, but we regret to say that we have not yet completed all the details in connection with this design because many such details now seem to involve the present standard No. 15 beam in which interchangeability and further standardization of certain parts that may be used for both the No. 15 and No. 18 beams seems possible, and, of course, desirable, and some further study is necessary.

On numerous occasions your committee has been pressed for its approval of reversible struts of one kind and another comprising two or more parts. We have examined many types and designs of such struts over a period of years and we are in accord that they are undesirable in one or more features they embody, and that any merit they may possess seems entirely outweighed by the disadvantages introduced by their use. We therefore do not approve of any reversible struts employing two or more component parts.

Modification of Freight Retaining Valve

The question of redesigning the freight retaining valve in order to provide additional protection and variable control of brake cylinder pressures was acted upon by a sub-committee and a report submitted at our last regular meeting, which was accepted in general. However, a difference of opinion prevailed as to the most desirable size of the orifice openings and rates of blow down for the various grade operations encountered in nation-wide operation. It seems necessary to confer further with the manufacturers and to also determine by individual observation under the various operating conditions what dimensions and rates may be most satisfactory.

Applications of the molded rubber sleeve and the latest design of wasp excluder recommended in our report last year have been made but we are not yet in a position to make a definite statement as to their entire satisfaction. To date we have no unfavorable comments in respect to them and the indications are that they provide the protection desired.

Cleaning, Testing and Lubrication of AB Valves

You will recall that from previous inspections of experimental AB brake equipment in service on Pennsylvania and Santa Fe cars it was decided at the last inspection in 1937 to equip a number of these cars with improved design of brake-pipe strainer in view of the fact that previous tests of these strainers seemed to indicate there was a possibility that very minute particles of foreign matter may in time filter through the strainers and get into the valves. The manufacturers had previously realized this and were at that time prepared to supply the improved design. Your committee was also convinced they were superior in every way, but to definitely determine as to whether or not they would be entirely satisfactory throughout at least a three year period in actual service, they were applied to these cars. These strainers

have now been in service three years and arrangements are under way to make the necessary inspection and tests similar to those previously made.

Reclaimed or Reworked Brake Beams

In the reclamation of brake beams it has been the practice on some roads to apply hardened bushings to the pin hole in the brake-beam strut. It is our recommendation that this practice is only satisfactory with existing struts providing there will be not less than 3/16-in. wall thickness at any point of the boss surrounding the pin holes after the holes are drilled out concentric with the original pin-hole center to 1½-in. diameter and that the bushings are a tight pressed fit.

With respect to the new struts for the standard No. 15 beams, it is our recommendation that the strut dimensions given on Page 91 of Section E of the A. A. R. Manual be revised to show sufficient material surrounding the pin holes to provide ample strength at this area when the pin holes are drilled to 1½-in. diameter.

Stencilling of Cleaning Dates for AB Brakes

Due to the extended service period of AB brakes over those of the "K" equipment your committee is in accord with the Arbitration Committee's opinion that the stencilling of cleaning dates may not always remain legible throughout the allotted service period where the stencil is applied as shown on Page 123 of Rule 60, Code of Interchange Rules. We see no objection to the stencilling being applied on the side of the car at, or as near, the center of the car as practicable, or any other location that will insure it being legible at all times.

We are also in accord with the suggestion in reference to deleting the last sentence in Paragraph (h) of Interchange Rule 60.

Lubrication of Air Brakes

Supplementary to our recommendation last year in this connection in which reference was made to the need for approved lubricants for air-brake valves and cylinders, your committee is convinced it is imperative that the AB brakes be lubricated only with tested and approved lubricants in order to insure satisfactory performance throughout the longest possible service period, and specifications for oil or air-brake valves, graphite for air-brake valves, and grease for air-brake cylinders are recommended for your approval as the approved and standard lubricants to be used. [These specifications were included in this report.—EDITOR.]

Changes in Construction of AB Brakes

Certain minor changes have been introduced in the AB equipment since it was originally introduced into service that have very definitely improved their performance and service life. The items affected are:

Quick-action-chamber charging choke, piece No. 506277; brake-pipe strainer, piece No. 502904; emergency-piston spring, piece No. 501006; Reservoir release-valve end plate, piece No. 54963 and, wasp-excluder barrier in the quick-service vent passage, piece No. CV-276.

It is our recommendation that improved parts covered by the above mentioned piece numbers be substituted for those of previous designs and piece numbers as AB valves are given periodical attention in accordance with Interchange Rule 60.

The report was signed by W. H. Clegg (chairman), general superintendent motive power and car equipment, Grand Trunk Western; R. E. Baker (vice-chairman), general air-brake inspector, Boston & Maine; T. L. Burton, air-brake engineer, New York Central; C. H. Rawlings, superintendent of air brakes, D. & R. G. W.; L. S. Ayer, general air-brake inspector, Sou. Pac.; R. J. Watters, general air-brake inspector, Nor. Pac.; J. A. Burke, supervisor air brakes, A. T. & S. F.; Otta Swan, air-brake instructor, Union Pacific; J. P. Lantelme, general foreman, Pennsylvania; J. Mattise, general air-brake instructor, C. & N. W., and R. E. Anderson, general air-brake inspector, C. & O.

Discussion

In presenting the report, Chairman Clegg called attention to the oxidization test in the Oil Specifications, exhibit A, and to the Graphite Specifications. These, he said, should be referred to the Committee on Specifications and Tests for their approval.

The chairman of the committee was asked to explain what are the disadvantages of the two-part brake-beam strut, which the committee did not approve, and Mr. Clegg replied that the two-part reversible brake accumulates lost motion in service and results in the development of too much flexibility in the brake beam. T. L. Burton, a member of the committee, explained further that a strut between a compression and a tension member was partly in compression and partly in tension and that under such conditions, nothing but a solid member could fully retain its effectiveness.

The report was accepted and referred to letter ballot.

Report on Couplers And Draft Gears

Type E Couplers Breaking in Service

Acting upon information received that Type E couplers were breaking in service, an investigation was made of this condition by the members of the committee and also by the Mechanical Committee of the Coupler Manufacturers. An examination was made of 244 broken couplers, 221 of which were cracked or broken through the front face and 162 had received a heavy impact on the guard arm.

The committee, through its analysis, is unable to assign car design, coupler or attachment design, material or foundry practice as a factor in this problem. It has had no opportunity to investigate the service conditions under which these failures are occurring, but the face-breakage failures and broken-off guard arms are occurring in the transportation yards. The heavy impact on the guard arm is evidence that the speed at time of coupling is too great and that couplings are attempted with knuckles not fully opened. The correction lies in reducing speed to 2 m.p.h. at the time of coupling and insuring knuckle or knuckles being fully opened before coupling is attempted.

Top Lock-Lifter Link Hook of Type E Coupler Straightening Out in Service

Under certain conditions of wear, the straightening of the top lock lifter link hook is possible. This condition was taken care of by a redesign of the top lock-lifter link for the Type E coupler which has been approved by your committee and the change in design was put into effect, December, 1939.

Train Partings of Standard Type E Couplers

During the year, it has come to the attention of your committee that some train partings have occurred between new cars built in 1936 and 1937 and equipped with standard Type E couplers. It has also been reported that standard Type E couplers have been found with bottom lock lift toggles missing and in an inverted position. In either case the coupler lock would be deprived of its anticreep feature. This condition was immediately brought to the attention of the Mechanical Committee of the Coupler Manufacturers, and a thorough investigation and study has been made of these conditions.

To eliminate these conditions, proposed changes in the several types of rotor levers and the toggle consist of a redesign on the basis that one end of the rotor lever in each case is provided with a jaw into which the toggle is fitted and retained definitely in this assembled position by means of a rivet. In the passenger Type No. 1 arrangement, the rotary lock lifter link is also riveted to the rotary lock lifter lever. The new design of rotor lever and toggle will be furnished completely assembled and riveted together. These proposed changes in the several bottom rotor levers and the toggle will affect the design of the present standard gages. The gages will therefore be changed in accordance with the changes affecting the above coupler parts.

Your committee at its meeting on February 19, 1940, at Cleveland, approved the above proposed changes in design of the bottom-rotary lock lifter and toggle and recommended that gages for properly checking this revised design be prepared and put into service for the Type E coupler. These changes became effective in the fitting of new couplers and for repair parts by all coupler manufacturers about June 1, 1940, and do not require any alteration in the uncoupling rods.

It is to be understood that to date very little trouble has been experienced from these toggles either missing from couplers in service or improperly applied on account of any wear that has thus far taken place. The improvements herein presented are for the purpose of correcting any conditions that may be encountered in the future and to improve the design of the E coupler mechanism.

Type D Couplers Opening in Service

On May 13, 1938, Circular DV-935 was sent out to the membership calling attention to means for preventing separation of bottom-operated Type D couplers in passenger service by application of the No. 3 lock lift toggle. Since that time, this condition of trains parting with Type D couplers seems to be relieved in passenger service, but information has reached your committee that separations are occurring on top-operated Type D couplers in freight service. There are two conditions in freight service that may contribute largely to the opening of these Type D couplers. Indications are that the most prominent factor in these train partings is the use of push-down-type operating levers. The other condition responsible for top-operated Type D couplers coming open occurs in couplers to which the No. 3 top lock lifter has not been applied, or the No. 2 top lock lifter not built up on the anticreep to conform to the No. 3 design.

The committee again emphasizes the importance of maintaining the No. 3 type of lock lifter in top-operated and No. 3 toggles in bottom-operated Type D couplers in order to prevent train partings caused by couplers of this type opening in service.

Types D and E Couplers—Fully Locked Position

The question has been raised as to the method of determining when Types D and E bottom-operated couplers are in the fully locked position.

In order to demonstrate this condition, Fig. 1 was prepared to show the Types D and E couplers in the lock-set position and in the fully locked position. It will be noted that in the Type D coupler in fully locked position, the bottom of the lock extends slightly below the bottom of the coupler head, and the toggle is practically fully visible. In the Type E coupler in fully locked position, the bottom of the lock is approximately flush with the bottom of the head and the greater portion of the toggle is visible. (The diagram is not included in this abstract.)

Reclamation of Draft Key and Knuckle Pins

The secretary has referred to this committee two items relative to reclamation mentioned in Circular D-VI-483. One of the topics in question relates to condemning draft keys. To date, the committee has insufficient information to establish definite condemning limits for wear for draft keys but proposes to do so during the coming year. Where the keys have worn to any appreciable extent some roads in their rebuilding program make it a practice to restore the width of the keys by either upsetting or fullering the keys longitudinally.

Fig. 2 shows a method of reclaiming these draft keys and is included in this report as a guide. The limits given will be subject to review when definite limits are established for keys reclaimed.

The other item referred to this committee is the method of straightening knuckle pins and the heat treatment necessary for reclaiming pins. This process is clearly prescribed in the A. A. R. Manual of Standards and Recommended Practice, Section C, Page 68, Item 4, Paragraph (b).

Yoke Substitute for Odd-Length Gear Pockets

A study has been made toward the development of a horizontal key type coupler yoke that might be used as a substitute for the riveted type yoke or non-standard design of cast steel yoke. The type of yoke that appears to best meet this condition is a combination of cast-steel head and forged yoke straps, as shown in diagrams submitted with this report. (The diagrams are not included in this abstract.)

The use of a yoke of this type would enable repairs to be made without having to carry in stock yokes of a variety of lengths. The cast-steel heads can be carried in stock and straps of the proper dimensions riveted to the head. It is the opinion of your committee that this type of construction will facilitate repairs and the design is presented with the recommendation that the proposition be submitted to letter ballot.

Specifications for Second-Hand Couplers

Included in the committee's annual report for 1937 were specifications for second-hand couplers. These specifications were adopted as recommended practice in 1937 and it is the recommendation of your committee that these specifications be advanced from recommended to standard practice. It is further recommended to the Arbitration Committee that Section 4 of the second-hand coupler specifications, prohibiting the painting of second-hand couplers, be made mandatory through the Interchange Rules.

The Arbitration Committee has recommended "that the requirement for coupler body to be steel stamped on the side of the lock chamber when it contains one or more reclaimed parts, be eliminated, for the reason that these parts may be removed within a short period of time and new parts applied. Furthermore, the rules require stamping on or adjacent to any welded portion of the coupler body, in which event many couplers thus carry two steel stampings."

The Arbitration Committee further states that it is inconsistent to place a requirement in the Interchange Rules to prohibit the painting of reclaimed or second-hand couplers when no such prohibition is provided for truck sides. These recommendations were carefully considered by your committee and it does not concur in them.

The present requirements were incorporated in the Rules to protect car owners and after reviewing the matter, your committee is of the opinion that no change should be made in these requirements to insure that second-hand couplers are properly reclaimed and where coupler bodies are welded in the knuckle side wall that the work will be properly performed. There is no further requirement in regard to the welded detail parts that may be applied to couplers in repairs.

Insofar as prohibiting the painting of second-hand couplers, your committee believes that this is a proper requirement so that proper inspection may be made of the welding that has been done, and is consistent with the requirement for new couplers which are not permitted to be painted. Subsequent painting of the coupler by the car owner does not affect these specifications.

Interchange Rule 18—Paragraph (c)

The Arbitration Committee has recommended that the limiting

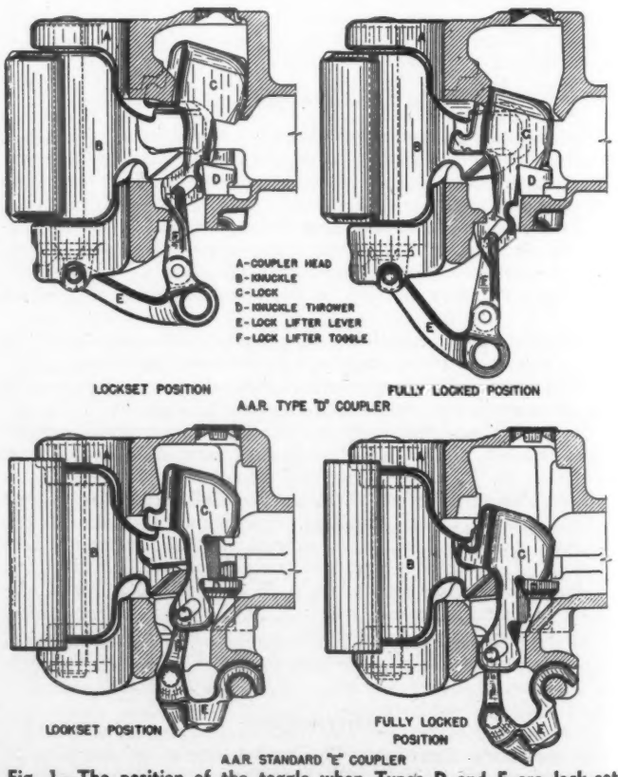
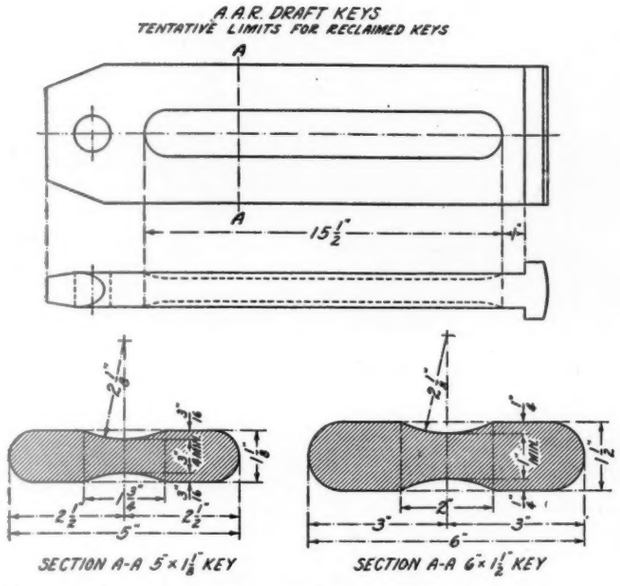


Fig. 1—The position of the toggle when Types D and E are lock-set and fully locked



Keys to be heated to forging temperature when making impressions. Size of impressions may vary but must not exceed dimensions shown. Restored keys to be quenched and tempered. Letters *H. T. S.* to be replaced on butt end of key with a 3/16-in. stamp when original letters are illegible.

Fig. 2—Method of reclaiming draft keys

dimensions for cracks in the shaded area in the knuckle side wall which do not warrant removal of couplers from service be extended from 7½ in. to 10 in. in length and from 3 in. above and 3 in. below center line to 4 in. in both instances, measured on the surface of the coupler.

This recommendation was considered and approved by your committee for condemning limits for couplers in service. It is, however, not recommended to extend the present reclaiming limits as now provided for in the Rules for the reason that cracks of the magnitude proposed for condemning the coupler cannot be satisfactorily reclaimed on account design of the coupler head. In order to clear up another point, in regard to the measurement of the cracks, it is suggested that these cracks be measured on the surface of the coupler.

The following change in Rule 18, Par. (c) is suggested to cover this matter:

Proposed Form—Coupler bodies, Types D and E, with cracks in knuckle side wall back of knuckle tail shall not be removed from foreign cars, unless—

(1) Such crack extends beyond the shaded area shown in Fig. D, page 57 (*4 in.* above and *4 in.* below the horizontal center line of knuckle side wall and *10 in.* back of front edge of knuckle side wall). *These cracks shall be measured on the surface of the coupler.* When crack extends beyond the shaded area, the coupler body is condemned. (2) Section is broken out within this prescribed area whose greatest dimension exceeds three inches. (3) *Coupler bodies must not be reclaimed by welding if the crack extends more than 3 in. above and 3 in. below the horizontal center line of knuckle side wall; or 7½ in. back of front edge of knuckle side wall; or section is broken out whose greatest dimension exceeds 3 in.*

Tight-Lock Couplers

During the year, trouble developed with tight-lock couplers parting in service. Your committee in cooperation with the Mechanical Committee of the Coupler Manufacturers made a thorough study and analysis to establish the cause.

It was found that these partings generally occurred during wet weather and it was difficult to reproduce the partings on the same couplers after they had occurred in service. The cause for parting was finally determined to be due to the secondary anti-creep being ineffective when there was a sudden impulse for the lock to lift particularly when the parts were wet or lubricated.

Changes were made in the contour of the secondary anti-creep ledge and the engaging toggle, and model and laboratory tests made to determine whether positive corrective action had been taken, followed by road tests in the New York Central yards at Cleveland, O., with the result that it was impossible to obtain undesired partings with couplers wet and lubricated. These tests were severe and several couplers other than tight-lock couplers were fractured during these tests. As a result of the analysis and tests conducted, Circular D.V.-977 was issued April 3, 1940, covering instructions for making adjustments to improve lock anti-creep to prevent parting in service.

Attention is directed to the necessity of making the adjustments to the tight-lock couplers in service or in stock on the railroads at the earliest practicable date, and discontinue the use of an "S" hook, or bolt, through the telltale hole in the toggle, as the use of such hooks or bolts prevents operation of the coupler by means of the uncoupling rod and is a violation of the U. S. Safety Appliance Rules.

The changes involved in the coupler consists of: (A) Change in contour of the secondary anti-creep ledge in the bar to provide for positive engagement of the anti-creep shoulder on the toggle. (B) Redesign of the toggle to improve the angle of and enlarge the secondary anti-creep shoulder. (C) Adjustment in the primary anti-creep shoulder at the front of the lock to improve the engagement of the primary anti-creep shoulder at the front of the bar, and also to assist the positive engagement of the secondary anti-creep.

These changes were authorized by your committee as it was essential to take immediate action and your approval of these changes is respectfully requested as it is not considered necessary to submit them to letter ballot.

Specifications for Tight-Lock Couplers

Specifications for the purchase and acceptance of A. A. R. tight-lock couplers and coupler parts, radial connections, yokes, and attachment parts were appended to this report. It is recommended that these specifications be submitted to the Committee on Specifications for Materials for approval and then included in the letter ballot for adoption as recommended practice.

Protection of Coupler Operating Mechanism

It has been brought to the attention of your committee that some undesired uncoupling of passenger cars in service has been experienced due to objects striking the uncoupling rod handle or the bail to the uncoupling mechanism, and considerable study has been given to determine the best method to prevent this.

Jointly with the Mechanical Committee of the Coupler Manufacturers, your committee is working on a means for locking the operating lever and also a means for locking the bail to the uncoupling mechanism to the end that if anything strikes either the operating lever handle or the bail in transit uncoupling will not occur.

The locking of the uncoupling rod at each side of the car and of the bail to the uncoupling mechanism presents difficulty in design for which a solution has not yet been found. It is confidently expected that if the coupler operating mechanism is confined to one side of the end of the car, a satisfactory locking device could be readily developed.

While a number of designs have been evolved to accomplish the desired result, no conclusion has been reached to warrant your committee making any definite recommendation at this time. The committee solicits suggestions from the membership and will appreciate it if the representative members of the individual railroads will give to the committee the benefit of any recommendation they may have to make to overcome this reported trouble.

An expression from the membership is desired in regard to operating the coupler from one side of the car only, similar to freight cars. If the type of rod operating from one side of the car is satisfactory, your committee believes that an efficient locking device can be presented.

Report of Sub-Committee on Draft Gears

Approved Draft Gears: During the past year a conditional certificate of approval was issued for the Waugh-Clark 150-B draft gear. This brings to twelve the total number of draft gears approved to date, two of which are conditional approvals.

Attention is again called to the fact that conditional approvals are good for two years only, at the end of which time the gear may be advanced to fully approved status provided the service performance has been satisfactory. However, if the manufacturer involved already has an approved gear designed for the same pocket dimensions as the gear newly advanced to approved

status, one of these gears must be withdrawn and placed in the non-approved classification.

Several changes of minor character have been made in the official drawings identifying the various approved draft gears during the past year.

Check Tests of Approved Draft Gears: As a result of the check tests of approved draft gears, which were described in last year's report, a complete new approval test of one draft gear and a partial retest of another approved gear have been required. If these gears do not meet these tests, or if the manufacturers fail to submit the gears for retest within a reasonable time, existing certificates of approval will be withdrawn. The attention of all manufacturers was directed to the specific details wherein the gears submitted to check tests were below requirements. Car owners who have applied conditional approved draft gears will not be required to remove such gears from service if the approval status of gear is changed.

Since the first series of check tests showed that some new gears did not fully meet specification requirements, authority has been obtained to conduct another series of check tests within the present calendar year.

Draft Gears for Passenger Service: The committee submitted last year for comments and criticism proposed specifications for draft gears for passenger service. Since no comments were received, the secretary, under date of March 20th of this year, issued a circular letter to the members urging that comments or criticism be offered. Up to date of preparation of this report replies have been received from a total of thirty-four railroads.

There appears to be a strong feeling that any attempt to fix more or less arbitrary standards for passenger equipment draft gears at this time is somewhat premature, inasmuch as entirely new designs of gears are being introduced. Therefore, your committee has decided to make no recommendation for the present.

New York Central Recoil Tests: Several times during past years this committee has recommended that road tests be conducted by the association for the purpose of determining the effect of draft gear recoil in long freight trains. Present specifications for approved draft gears for freight service include no limit on percentage of recoil for the reason that no generally acceptable evidence exists to show what maximum percentage of recoil ought to be permitted under present day operating conditions.

During the past year the New York Central undertook to conduct such tests, and they were witnessed by the sub-committee. Two similar 100-car trains were used, one of which was equipped throughout with relatively high recoil gears, and the other with relatively low recoil gears. Both gears were approved types. Use of the brakes was limited to service applications.

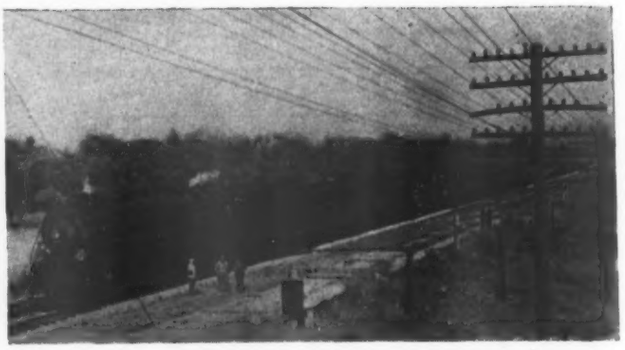
The results of these tests were not conclusive insofar as the effects of recoil were concerned; however, some interesting facts were disclosed and permission has been obtained to include as Appendix "A" of this report a condensed summary of the New York Central report for the information of members of the Association.

Appendix A—Recoil Tests

Object—The purpose of the tests was to determine the handling characteristics of a 100-car freight train equipped throughout with low recoil draft gears, Type X, as compared with a similar train equipped with relatively high recoil gears, Type Y, when subjected to service slow-downs and stops using various combinations of brake applications and grades intended to develop maximum train shocks.

Test Runs—Two test runs were made on the New York Central from Rochester, N. Y., freight yards to Gardenville, N. Y., freight yards, a distance of 65 miles, using the main line from Rochester to Chili Junction, 13 miles, and from there over the West Shore to Gardenville. The first test run was made September 20, 1939, with a train consisting of locomotive 2856, dynamometer car X-8006, 100 empty N. Y. C. box cars equipped with Type X draft gears, and a caboose. The total weight was approximately 2,410 tons. The second test run was made September 22, 1939, with a train consisting of locomotive 2851, dynamometer car X-8006, 100 empty N. Y. C. box cars equipped with Type Y draft gears, and a caboose. The total weight was approximately 2,390 tons.

A program of test stops and starts was developed during the first run with a view to producing maximum shocks without using emergency brake applications. This program was duplicated as nearly as possible with the second train.



One of the draft-gear-recoil test trains

Description of the Test Trains—The equipment of the two trains was identical as far as it was practicable to control it, the only major difference being the draft gears on each group of 100 box cars. All of the box cars had been selected from a lot recently converted from wood superstructure, steel underframe, to steel-sheathed body type by Merchants Despatch, Inc., at East Rochester, N. Y. None of them had been in service before these runs were made. The brake-cylinder piston travel for each car was approximately 7 in. and the braking ratio was approximately 58 per cent. There was no measurable brake-pipe leakage for either of the two trains.

The total slack in the train equipped with Type X draft gear was measured as 14 ft. 8 in., which amounts to 0.88 in. (about ⅞ in.) per car end, and for the train equipped with Type Y draft gear it was measured as 17 ft., which amounts to 1.02 in. per car end. It is believed that this difference in slack between the two trains is largely due to inaccuracies resulting from the method of measurement, which consisted of bunching and stretching the train and measuring the total travel. It may also represent a difference in lost motion between the coupler knuckles of the two trains, for no detail measurements of coupler slack were made. New and second-hand coupler knuckles were used when rebuilding these cars, but the proportion of each applied to the cars involved in these tests was not recorded.

Recording Instruments and Apparatus—The locomotive was equipped with a Valve Pilot to indicate speed and cut-off, and the brake valve was fitted with an electrical actuating device to record brake-valve action on dynamometer car chronograph. Brake-pipe pressure reductions were recorded from the gage on the locomotive.

In the dynamometer car, draw-bar pulls and buffs, speeds, distance, locations, time and locomotive brake-valve actuations were recorded. In the dynamometer car, and in four cars, the twenty-fifth, the fiftieth, the seventy-first and the one hundredth box cars from the head end of the train, Symington-Gould tumbling-block lading dynamometers were attached to the floor of the cars to measure shocks imposed on the cars. In addition, the fiftieth car carried two Redhed and one Westinghouse Air Brake Company's recording accelerometers.

Each tumbling block instrument contained a number of blocks arranged to tip over under various degrees of shock. The individual blocks are designated by numbers representing the acceleration in per cent of gravity required to tip over the block.

Test Procedure—Brake applications were made under various conditions of speeds and grades, with a view to developing maximum shocks with service brake applications. Starts were made with and without taking slack.

In the first three tests, brake applications with various brake-pipe reductions were made to ascertain the behavior of the train. For the later tests, brake applications were chosen with a view to producing maximum train shocks with service brake applications.

Test Results—The accelerations shown by the tumble-block dynamometers in various positions of the train are summarized below:

In the three preliminary tests (Nos. 1, 2 and 3) no blocks were tipped over. The greatest shocks were registered in Tests Nos. 6 and 8. In Test No. 6 stop was made with 25 lb. per sq. in. brake-pipe reduction at 15 m. p. h. on a 0.38-per-cent rising grade. The locomotive brake was applied at the same

time as the train brake. In Test No. 8 stop was made with 25 lb. per sq. in. reduction at 20 m. p. h. on a down grade of 0.25 per cent. The locomotive brake was applied five seconds after the train brake.

The only other braking tests in which blocks numbered higher than 20 tipped over were Nos. 9 and 11. In Test No. 9 at 15 to 17 m. p. h. on a 0.25 per cent descending grade the throttle was closed and the locomotive brakes applied. Five seconds later the brakes were released and the throttle opened wide. In Test No. 11 at 11 m. p. h. on level track a stop was made with a 25 lb. per. sq. in reduction. The locomotive brake was applied at the same time. In starting and taking slack, blocks of higher value than 20 were tipped over during only three sets of starts.

In all cases no acceleration is recorded for car 71 in any of the tests. Slight shocks were felt, but this car had no tumbling block with a value lower than 100. In the dynamometer car no tumble blocks were tipped over during the test runs. The records obtained with the Redhed and the Westinghouse accelerometers were in line with results obtained with the tumble-block dynamometers, but do not add any information of special interest.

The tests were carried out under the supervision of E. L. Johnson, assistant chief engineer of motive power and rolling stock, New York Central, and H. W. Faus, engineer of motive power, New York Central, and were witnessed by members of the A. A. R. sub-committee on draft gears.

Conclusions—No excessive shocks were produced, with the result that practically no difference in handling was observed between the two trains under the conditions of the tests.

Neither of the two types of draft gears tested gave any indication of any action which might be considered as prejudicial to the use of the gears in regular service.

The fact that the highest value lading block to tip over during these tests was only 60 per cent g., indicates that the maximum force exerted on the draft gear of any instrument car was approximately 29,000 lb. Since this is less than the initial compression under which both types of gears are assembled, this leads to the conclusion that the forces set up in this train were not sufficient to cause the draft gears to function in such manner as to make it possible for them to exert any recoil.

The report as a whole was signed by R. L. Kleine (chairman), assistant chief motive power-car, Pennsylvania; H. W. Coddington (vice-chairman), chief chemical and test engineer, N. & W.; E. E. Root, chief motive power, D. L. & W.; L. P. Michael, chief mechanical engineer, C. & N. W.; J. P. Morris, mechanical superintendent, A T. & S. F., and H. W. Faus (chairman, subcommittee on draft gears), engineer motive power, N. Y. C.

Discussion

H. W. Gilbert, National Malleable & Steel Castings Company, stated that the coupler manufacturers have endeavored to cooperate in improving coupler design and service, and that their efforts in this direction can be rendered more effective if the railroads will supply the manufacturers Mechanical Committee, of which he is chairman, with full information regarding all coupler defects as they are developed. The Mechanical Committee must have representative samples which will illustrate conditions in order that proper corrections and improvements in design may be effected.

P. P. Barthelemy, master car builder, Great Northern, referred to the drawing of the cast-steel head used with the A. A. R. wrought-iron yokes and raised the question if the holding power of the rivets should be supplemented by welding the yoke ends to the coupler head. Chairman Kleine replied that this is not considered necessary, since the rivets are in double shear.

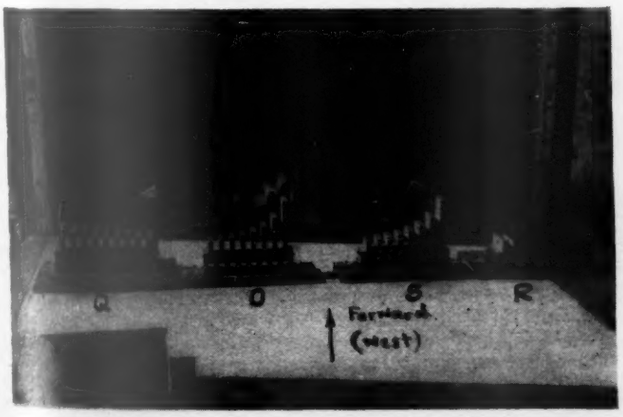
R. G. Henley, superintendent motive power, N. & W., suggested the use of a filler ahead of the yoke to prevent couplers from drooping and raised the question if the coupler should not be designed for satisfactory coupling at speeds up to 4 m. p. h. instead of 2, as specified in the committee report, inasmuch as draft gears are designed to meet the higher speed requirement. He expressed appreciation for the committee's action in extending the condemning limit for cracked side walls because a few railroads have been taking advantage of this rule to remove couplers which should not be removed. Mr. Henley said that a record of coupler breakages indicates that 95 per cent of the damage is done in hump-yard switching.

Chairman Kleine replied that the yoke head, coupler butt and key are designed with close tolerances so as to reduce slack and prevent the coupler from drooping. While car impact speeds up to 2 m. p. h. are recommended for satisfactory coupler closure, Mr. Kleine said that couplers will not necessarily fail when striking a speed up to 4 m. p. h., as a substantial factor of safety is included in the design. He maintained that the question of speed in hump-yard switching is a matter of regulation and may be reduced to 2 m. p. h. at the moment of impact without slowing up yard operation.

This opinion was challenged by D. S. Ellis, chief mechanical officer, C. & O., and by K. F. Nystrom, mechanical assistant to the operating vice-president, C. M. St. P. & P., and supported by E. B. Hall, general superintendent of motive power, C. & N. W., who said that the hump-yard operation would not necessarily be slowed up, since two cars are seldom switched one immediately after the other down the same track.

Mr. Nystrom suggested that a study be made to determine the impact strength of cast steel at sub-zero temperatures as a possible cause of coupler failures and Chairman Kleine said, in closing, that this and other questions developed in the discussion will be given further consideration by the committee.

The report was accepted and referred to letter ballot.



Tumbling-block dynamometers in the fiftieth car from the head end—Recording accelerometers are in the background

Report on Tank Cars

During the past year the committee considered a total of 413 dockets and applications for approval of designs as follows:

Two hundred and forty-seven covered designs, materials and construction of 3,829 new shipping containers, for application to new cars or for replacement on existing cars, in the number and of the classes listed in the table.

New Shipping Containers Considered by the Committee

Class	No. of tanks
I. C. C.-103	628
I. C. C.-103-W (Fusion welded seams)	276
I. C. C.-103-A	259
I. C. C.-103-A-W (Fusion welded seams)	2
I. C. C.-103-B	37
I. C. C.-103-B-W (Fusion welded seams)	20
I. C. C.-103-C-AL (Aluminum tank)	1
I. C. C.-103-C-W (Fusion welded seams)	5
I. C. C.-104	1
I. C. C.-104-A	42
I. C. C.-105-A-300	76
I. C. C.-105-A-300-W (Fusion welded seams)	402
I. C. C.-105-A-400	1
I. C. C.-105-A-500	36
I. C. C.-106-A-500	1,871
A. A. R.-201-A-35-W (Fusion welded seams)	37
A. A. R.-203	87
A. A. R.-203-W (Fusion welded seams)	48
Totals	3,829

Three applications covered eleven multiple unit cars to be used for the transportation of fifteen Class I. C. C. 106-A-500 one-ton containers each.

One application covered two new underframes and trucks on which would be mounted existing tank car tanks.

One hundred and forty-one applications covered alterations in, additions to or conversions and reconditioning of 2,751 existing tank cars or shipping containers.

Alterations in Existing Tank Cars or Containers

Class	No. of cars or tanks
A. A. R.-II	8
A. A. R.-III	1,100
A. A. R.-IV	1
A. A. R.-V	9
I. C. C.-103	112
I. C. C.-103-A	6
I. C. C.-103-B	2
I. C. C.-105	1
I. C. C.-105-A-300	20
I. C. C.-106-A-500	1,476
A. A. R.-201-A-35-W	3
A. A. R.-203	3
A. A. R.-203-W	1
Multiple unit tank cars	9
Total	2,751

Hearings are now tentatively set for an early date on the proposed general revision of the Interstate Commerce Commission Specifications For Tanks To Be Mounted On Or To Form Part Of A Car, indicated by the Committee's report of May 29, 1939 to have been previously submitted to the I. C. C.

Specifications for Fusion Welded Tank Car Tanks

At public hearings before the Interstate Commerce Commission, during September, 1934, your committee recommended the adoption of specifications, then presented, which would permit the construction of tank car tanks fabricated by means of fusion welding. Your committee, at the same time, recommended the use of tank car tanks so constructed for the transportation of articles classed as dangerous.

Proposed Alterations, Additions, Conversions or Reconditioning Operations, Affecting the 2,751 Cars or Shipping Containers

Application of heater systems.
Application of lagging.
Application of rubber lining.
Center Sills, reinforcing of.
Capacity reduced.
Conversion from A.A.R.-III to A.A.R.-III Insulated.
Conversion from A.A.R.-III Insulated to A.A.R.-III.
Conversion from A.A.R.-IV to A.A.R.-III Insulated.
Conversion from A.A.R.-IV to A.A.R.-III.
Conversion from A.A.R.-IV-A to A.A.R.-IV.
Conversion from I.C.C.-103 to I.C.C.-103 Insulated.
Conversion from I.C.C.-103-A to I.C.C.-103-A Insulated.
Conversion from I.C.C.-103 to A.A.R.-203.
Conversion from I.C.C.-103 to A.A.R.-203 Insulated.
Conversion from I.C.C.-103-B to I.C.C.-103-B Insulated.
Conversion from I.C.C.-103-B to A.A.R.-203 Insulated.
Conversion from I.C.C.-104 to I.C.C.-103 Insulated.
Conversion from I.C.C.-103 to I.C.C.-103-A.
Conversion from I.C.C.-103-A to I.C.C.-103-B.
Dome fittings and unloading arrangements altered.
Bolster slabbing area increased.
Reconditioning one-ton shipping containers.
Underframe reconditioned, in connection with the application of new tanks.
Alter for sulphur dioxide service.
Transfer from metallic sodium to ammoniating solution service.
Conversion from Acid Sludge to petroleum products service.
Dome and fittings renewed (not in kind).
Add jacketed outlet.
Cutting of present dome head—application of new dome shell.
Bolster slabbing and tank band snubbers applied.
Removal of washout—addition of 4" positive outlet.
Alter from General Service to Sulphuric Acid Service.
Repairing crack in manway by fusion-welding.
Alter from fertilizer ammoniating solution to General service.
Application of tank reinforcing rings under dome.
Conversion from Metallic Sodium to propane service.

A general revision of the 1934 proposed fusion welded specifications has been formulated, to incorporate necessary modifications in line with changes in the art, and to harmonize the requirements for tank car tanks, as near as is practicable, to the requirements of other code authorities.

Every effort is being made by the committee to complete their review of these revised fusion welded specifications to permit of submission of same to the I. C. C. so as to receive consideration at hearings proposed to be held in the near future on general revision of the currently effective shipping container specifications covering riveted and forge welded tank car tanks.

Fusion Welded Tank Car Tanks

Since the public hearings before the I. C. C. at Washington, D. C., on September 5, 6 and 7, 1934, on the matter of fusion welded tank car tanks the commission has authorized the construction of a total of 1,074 tank car tanks, fabricated in conformity with the proposed specifications then submitted, and their use in experimental service trials transporting articles classed as dangerous by their Regulations.

To date certificates have been filed indicating that, of the cars so authorized to be equipped, 442 have been constructed and placed in service. Since last report no advices have been received of any of these cars having been involved in accidents.

Reports are regularly received covering conditions of all fusion welded tank car tanks authorized for experimental trials. In addition, these reports also supply service records. These reports indicate a satisfactory performance for the fusion welded tanks now in service after having traversed 10,113,311 miles, during 13,530 trips.

Twenty-One Applications Requesting Approval of Tank Car Appurtenance Designs, without Reference to Specific Cars

Applications	Tank-car appurtenances
1	Safety valves equipped with breaking pin device and having upper and lower diaphragm for single unit chlorine tank cars.
1	Spot welding of safety appliance bolt nuts in place of riveting.
1	Dome platform arrangement for Class I.C.C.-104 tank cars.
1	Johns-Manville "HP" Stonefelt Insulation.
1	Johns-Manville type "WS" Stonefelt Insulation.
1	Nozzle Construction for I.C.C.-105-A-W tank cars.
1	Design of hand rail arrangement for multiple-unit tank cars.
1	Valve for slip tube gaging device.
1	Design of anchor rivet cap construction for all classes of I.C.C. fusion welded tank car tanks except I.C.C.-105-A series used for chlorine.
1	Design of anchor rivet cap for all classes of fusion welded tank car tanks which are not stress relieved.
1	Tank car loading and unloading valve with safety check valve —for pressure below 40 lbs. sq. in. for Class A.A.R.-IV or I.C.C.-104 tank cars.
1	Proposed bushing design for worn pipe connections on angle valve body for Class I.C.C.-105-A series chlorine tank cars.
1	Cast steel housing for valves and fitting to be applied to A.A.R.-III, IV, or I.C.C.-103 and 104 tank cars.
1	Bushing design for worn pipe connection on angle valves for Class I.C.C.-105-A chlorine tank cars.
1	Installation of Nickel Lining fusion welded in place and exterior heater coils to one (1) Class I.C.C.-104 tank car.
1	Installation and use of battery to supply counter electric current to Caustic Soda Liquor shipped in nickel clad tank cars.
1	Proposed 6" positive steam jacketed clapper type outlet valve.
1	Dome arrangement for Class I.C.C.-103-A tank cars.
1	Lead discs having 1/16" breather holes.
1	A.A.R. 16" hinged and bolted type manway with protective housing for loading and discharge fittings.
1	Alteration in disc assembly for 1" angle valve for use on Class A.A.R.-V, I.C.C.-105, I.C.C.-105-A-300 and 105-A-500 tank cars.

With a view to clarifying present standard definitions for tank cars your committee recommends submission to letter ballot proposed definitions for Class T tank car type cars and supplementary table as outlined by Appendix A. (Not included in the present abstract of the committee report.)

Tank Car Safety Appliances

Appendix A of United States Safety Appliances Hand Book, covering safety appliances for tank cars, was last revised during 1920. Since that time there have been a number of changes necessitated by the demands of shippers and their customers. Since parties proposing the construction of tank cars are required to secure committee approval before placing same in service and as no requirements outlining details of the additional appliances required by these demands have been adopted and published for general use this has necessitated submission of such applications to the Committee on Safety Appliances. With a view of eliminating delays attendant upon such handling your committee is formulating a general revision of Appendix A, to be designated as Appendix B, outlining safety appliance requirements for tank cars constructed in the future. Proposed Appendix B after concurrence by all parties will be submitted to the voting members for adoption by letter ballot.

Appendix A—Definitions and Designating Letters for Tank Cars

Proposed Form—Class T Tank Car Type, "TM"—Tank car

for transporting oil, gasoline, or other liquids, including liquefied compressed gases, but not including acids. Consists of a riveted, fusion welded or forge welded tank mounted on car structure. Design of tank and appurtenances for these cars is dependent upon the lading to be transported. Tanks must be equipped with safety valves or safety vents. Unloading may be through bottom discharge or, if not so equipped, overhead.

"TA"—Tank car for acid service. Of same general design and construction as oil tanks except same must be equipped with safety vents and overhead unloading arrangement. Safety valves and bottom discharge is prohibited.

"TL"—Tank car of same general construction as "TA" car except that tank is lined with aluminum, nickel, rubber, tin, zinc, etc., (except glass) to resist corrosive action of lading or prevent its contamination.

"TG"—Tank car having one or more glasslined tanks for transporting mineral water, etc.

"TGB"—Tank car for transporting beverages, etc., having two cylindrical metal tanks (with or without lining), the loading and unloading devices for same being enclosed within, and protected by a cab located between the tanks.

"TMN"—A car of suitable design for transporting removable non-dangerous articles containers.

"TMU"—A car of suitable design, including cradles and anchorage, for use in transporting liquefied compressed gas ton-containers of Class I. C. C.-106-A series and cars of I. C. C.-107-A series for transporting compressed gases.

"TW"—A car equipped with one or more wooden tanks, or, one or more metal or wooden tubs. Such tank or tubs may be lined. Car is sometimes equipped with a roof.

Note 1—Where tanks, tubs or containers mounted on any of the preceding Tank Car Type Classes are insulated the letter "I" should be affixed to their applicable designating letters. For example, TAI, TGI, TGBI, etc.

The report was signed by G. S. Goodwin (chairman), mechanical engineer, C., R. I. & P.; F. A. Isaacson (vice-chairman), engineer car construction, A., T. & S. F.; A. G. Trumbull, chief mechanical engineer, C. & O.; B. M. Brown, assistant superintendent motive power, Sou Pac.; W. C. Lindner, chief car inspector, Penna.; A. E. Smith, vice-president, Union Tank Car Company; G. A. Young, head, School of Mechanical Engineering, Purdue University; F. Zeleny, engineer of tests, C., B. & Q.; W. C. Steffa, transportation manager, Sinclair Refining Company; R. T. Baldwin, secretary, The Chlorine Institute, Inc.; H. J. Gronemeyer, supervisor, car equipment, E. I. duPont de Nemours & Company, Inc.; and R. W. Thomas, manager, Phillips Petroleum Company.

The report was accepted without discussion.

Report of Committee on Loading Rules

The annual report of the committee for 1940 embodies several changes in the present rules, as well as a number of new rules recommended by the shippers, all of which are of such importance as to merit very careful consideration.

During the past year we have again received the splendid cooperation of the shippers, as well as the member lines. The recommendations presented by the shippers have been very helpful to the committee in formulating new rules and modifying the present rules, where modification was deemed necessary to produce an economical, substantial and safer load. It is very gratifying to this committee to receive this excellent cooperation and support for the further betterment of loading practices and we, with the Association, desire to extend our sincere appreciation.

Experimentations with several new methods of load securement are in process and the results of the tests so far are very gratifying.

Two meetings have been held with the shippers during the past year, one with the lumber interests (creosoted pole shippers) in the south and one with the steel industries, both of which brought about a better understanding of the problems that confront the carrier and shipper.

The following changes and new rules are presented for your approval and adoption to become effective in supplement to the rules to be issued subsequent to the Annual Meeting.

General Rules

Rule 10

Add new sentence to Section (c) to read: "Stakes may be placed either in or out of stake pockets on inside of gondola cars with sides 30 in. high or over, provided they rest on car floor and are securely wedged to car sides by lading."

Reason: To clarify the rule.

Add new sentence to Section (d) to read: "Boards, lengthwise of car, attached to stakes above top of car sides, must be nailed to inside of stakes."

Reason: To eliminate the possibility of boards becoming detached in transit.

Change Section (f) to read: "Such fastenings need not be used when top tier of H and I beams with flanges 6 in. wide or more are loaded flatwise, and lower edges of flanges extend at least 4 in. below top of car sides and confined inside the flanges of beams underneath."

Reason: Greater safety.

Rule 11

To read as follows: "Substitution for High Tension Wire and Bands.—Where high tension bands or high tension wires are specified in the detailed rules, they may be substituted for each other, if of equal load strength, provided all the other items used to secure the load are equal in number and strength."

Reason: To serve as guidance.

Rule 14

Add new rule to read: "Nails. (See Figure 1-B.)"

Reason: To indicate the sizes of nails for the guidance of the shippers.

Rule 15

Change first paragraph Section (c) to read: "The substitution of high tension bands or high tension wires for rods, bolts or bands with threaded ends is permitted only when specified. When used they must have a percentage elongation in 6 in. from 5 to 16 per cent, inclusive.

Reason: Bands now used are generally hot rolled.

Change third paragraph Section (c) to read: "High tension bands or wires, encircling pile must be machine tensioned, sealed or twist tied, respectively, on top of load, when possible."

Reason: To indicate that it refers to machine tensioning.

Change fourth paragraph Section (c) to read: "Twist tie the ends of each wire to provide 85 per cent load strength. Seal each band with one double crimp or two single crimp seals, 85 per cent load strength of band, except otherwise specified."

Reason: To clarify the intent.

Rule 16

Change Section (d) to read: "Authority must be procured for handling loads which measure more than 8 ft. from top of rail to center of load."

Reason: To provide that all loads exceeding this height must be handled as special loads.

Rule 18

Change Section (a) to read: "The width of load, distance between bearing-pieces, and length of overhang must not exceed the dimensions shown in tables No. 3 to 35, inclusive. For loads of uniform width throughout length of load, the minimum width *W* is to apply. Authority must be procured for handling loads which measure more than 8 ft. from top of rail to center of load."

Reason: The following wording has been eliminated account being fully covered by General Rule 7, "for loads 12 ft. high or less, measured from top of rail to top of load. For loads over 12 ft. high from top of rail to top of load, the given width must be reduced 2 in. for each inch in height for that portion of load in excess of 12 ft." Last sentence has been added to indicate that all loads exceeding this height must be handled as special loads.

[The remainder of the report was devoted to the details of revisions made either to the drawings or the text accompanying the drawings in Figs. 3, 5, 6, 22, 27, 27-A, 29, 30, 31, 51, 51-A, 63, 63-A, 66, 69, 134, 135, 198 and 199-A. New figures 71-A, 84-B and 200-A were added, covering the loading of wire mesh in rolls, transite pipe and granite.—Editor]

The report was signed by W. B. Moir (chairman), chief car

inspector, Pennsylvania; C. J. Nelson (vice-chairman), superintendent interchange, Chicago Car Interchange Bureau; R. H. Dyer, general car inspector, N. & W.; H. S. Keppelman, superintendent car department, Reading; T. W. Carr, superintendent rolling stock, P. & L. E.; A. H. Keys, district master car builder, B. & O.; H. H. Golden, supervisor A. A. R. Interchange and Accounting, L. & N.; H. T. DeVore, chief interchange inspector, Youngstown Car Inspection Association; H. J. Oliver, general car inspector, D. T. & I.; and F. G. Moody, master car builder, Nor. Pac.

Discussion

In presenting this report, Chairman Moir said that a study of disarranged loads during the period between January 1 and May 1, 1940, indicated that 3,465 cars were shopped for readjustment of the load, 1,898 being due to yard switching and 1,367 to road haul, the estimated cost of labor and material for this work, estimated on an annual basis, being $37,825. This cost must be reduced by an organized campaign carried out with the same thoroughness as the safety program. Only about 50 per cent of the cases of load shifting are reported by the railroads, according to Chairman Moir, who expressed appreciation for the excellent cooperation secured from many shippers, especially in the handling of experimental test loads. J. McMullen, superintendent car department, Erie, said that this report is always important and must represent the result of intelligent research and complete cooperation between railroads and shippers if desired results are to be obtained. He called attention to the use of high-tensile steel bands and wires as an important factor in modern loading; urged the closer observance of loading rules; stressed the importance of reporting all failures; urged closer supervision of loading practices by the transportation department, and said that the membership should cooperate more fully with the Loading Rules Committee, as all apparently do not realize the amount and importance of the work which it does in the interest of the railroads as a whole.

The committee report was adopted.

Intercrystalline Cracks in Locomotive Boilers[1]

By W. C. Schroeder[2]
A. A. Berk[3]
R. A. O'Brien[4]

Approximately 500 locomotive boilers are known to have suffered embrittlement or intercrystalline cracking during service on American railroads. The actual number may be considerably greater as statistics on this type of failure are extremely difficult to make complete. The major portion of this cracking had been confined to four or five railroads but it has recently cropped up on a number of roads heretofore free from this trouble.

The use of welded drums in stationary practice probably presages steady diminution of intercrystalline cracking in this field, for such construction eliminates the riveted areas which experience has shown to be most prone to this type of failure. In locomotive boilers no general tendency toward the use of welded drums is yet in evidence, consequently alleviating the trouble depends on proper attention to (1) the construction of the boiler, (2) the treatment of the feedwater, or (3) combination of the best construction with adequate feedwater treatment.

The Association of American Railroads, recognizing this situation, has contributed generously to an extensive investigation of this problem. From the standpoint of protecting riveted stationary boilers already in service, the work has also been sponsored since its inception by the American Boiler Manufacturers Association, American Society of Mechanical Engineers, American Society for Testing Materials, American Water Works Association, Edison Electric Institute, and other interested groups.

This investigation has been carried out in cooperation with the Bureau of Mines,[5] which has furnished not only excellent facilities but also the services of experimental investigators.

Considerable attention has been devoted to understanding how the cracks occur as a guide toward finding and evaluating methods of feedwater treatment that may be used to prevent them.

Three factors combine to produce intercrystalline cracks in a boiler: (1) leakage that allows concentration of the boiler water, (2) high stress in the boiler metal, arising either from cold work or applied stress, and (3) chemical action of the concentrated boiler water on the stressed steel.

Concentration of the Boiler Water

It has never been possible to show that a dilute alkaline solution, such as ordinarily present in a locomotive, will produce intercrystalline cracks when in direct contact with stressed specimens of normal low carbon steel at any temperature used in boiler operation. It is not necessary to show this, however, to account for the appearance of intercrystalline cracks in a riveted boiler seam. Instead of the dilute water acting on the steel, a *concentrated* solution produced in the seam is the attacking agent.

Several mechanisms have been advanced to explain this concentration process. That most easily demonstrated depends on the extremely slow diffusion of water vapor out of the seam to leave therein a deposit of concentrated solution and solid.

Fig. 1 shows on a greatly magnified scale a small leak between the drum metal and butt strap of a boiler. Point *A* represents an opening so small that the boiler water can diffuse through it only very slowly. As this occurs, the heat in the metal and in the liquid will cause evaporation toward atmospheric pressure to produce a more concentrated solution. Still farther away from the opening more evaporation has occurred and the boiler water is quite concentrated. Next, solids such as sodium sulfate and chloride begin to crystallize from solution, and finally substantially all the water is evaporated.

From Fig. 1 it is apparent that the rate of leakage must be confined within certain limits to produce a concentrated solution. If no leakage occurs, concentration is not possible. On the other hand, if opening *A* is too large, the water will rush out so rapidly that concentration may not occur in contact with the stressed metal. The most dangerous type of leakage is that which allows an almost imperceptible loss of water vapor to the atmosphere.

Leakage as represented by Fig. 1 probably would never be directly visible on an engine and certainly never enough to cause

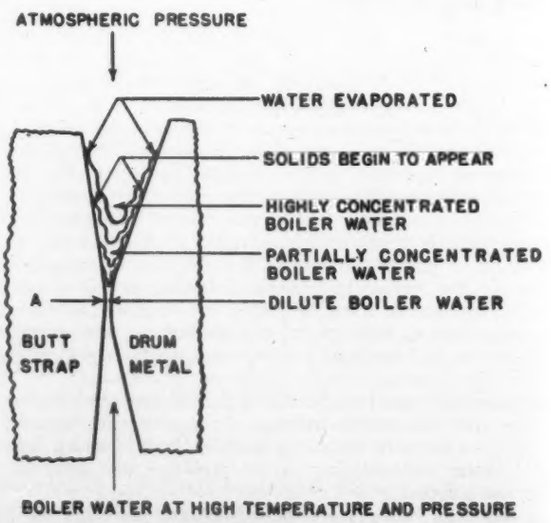


Fig. 1—Greatly magnified diagram of a leak showing concentration mechanism

[1] Published by permission of the Director of the Bureau of Mines—U. S. Department of the Interior.
[2] Senior chemical engineer, Eastern Experiment Station, Bureau of Mines, College Park, Md.
[3] Assistant chemist, Eastern Experiment Station, Bureau of Mines, College Park, Md.
[4] Assistant metallurgist Joint Research Committee on Boiler Feedwater Studies, attached to the Eastern Experiment Station, Bureau of Mines, College Park, Md.

[5] Abstracts of earlier investigations by the Bureau were published in the September, 1938, and June, 1940, issues of the *Railway Mechanical Engineer*.

removal from service. It could be discovered in a cold test only with most careful inspection. When the boiler is under full steam pressure, however, such leakage might be found with a cold glass or mirror on which steam escaping from a riveted seam will form a faint haze of condensate. Over long periods of time rates of leakage undetectable even by this rather sensitive means can create concentrated solutions.

High Stress in the Boiler Metal

It has been known for a long time that intercrystalline cracks occur most readily when the metal is under a high tensile stress. In fact no definite evidence has been advanced to show that they can be produced in unstressed steel or in steel subjected to compression.

This usually has been interpreted to mean applied stress; therefore in laboratory work to produce intercrystalline cracks the specimens were put under tensile load by dead weight, springs, lever or hydraulic systems. It can be shown that an applied tensile force is not always necessary to produce cracks. If the inner surface of a rivet hole has been cold-worked through punching, drilling, drifting, or other mechanical operation the necessary internal stress may exist to cause cracking in the absence of any further applied load.

The desirability of preventing extensive cold distortion of the metal during fabrication of the boiler is apparent from this work. Excessive distortion of the metal would create all the stress necessary to cause embrittlement, and at the same time would make it almost impossible to keep the boiler free from leaks that would allow the formation of concentrated solution in the seam.

For a number of years manufacturers have recognized the necessity for eliminating this type of construction. Plates are carefully fitted together, all burrs and chips are removed from between them, all rivet holes are drilled rather than punched, and the holes are reamed in place to secure proper alignment. Rivets are driven by machine so that the heads are well centered over the shanks.

Internal calking has been used quite generally in recent years, in locomotive construction. Operating experience has not as yet clearly demonstrated the superiority of internal-external calking over external calking alone.

To secure a tight fit between locomotive shell courses they are sometimes shrunk together. The advisability of this procedure is debatable. The shrinking probably secures a better fit between the shell courses, which will greatly aid in preventing leakage, but it may set up extremely high tensile stresses that will promote rapid cracking in case any concentrated solution does form. According to the writers' information one of the railroads which has had considerable difficulty with circumferential seam cracking did not follow the practice of shrinking courses together and it may be concluded that elimination of the stresses from this source is not a sure way to prevent embrittlement.

Action of Concentrated Solutions on Stressed Steel

In the riveted seam of a locomotive boiler we have seen that two of the conditions can exist which are necessary to cause intercrystalline cracking; namely, leakage that will allow the formation of a concentrated solution, and high stress in the metal. To actually crack the steel still another factor must be acting; a boiler water which on concentrating will have the correct chemical characteristics to attack the grain boundaries of the metal.

This chemical problem is extremely complex, and as it has been treated in some detail in previous publications only the most practical aspects concerning caustic solutions need be repeated here.

A stressed steel specimen placed in direct contact with a very concentrated sodium hydroxide solution, boiling under atmospheric pressure, will suffer intercrystalline cracking. This attack can be hastened greatly by adding very small amounts of certain chemicals, generally classified as oxidizing agents, to the solution. When the solution is raised from the atmospheric boiling point to temperatures used in locomotive operation, the oxidizing agents lose their effectiveness in accelerating the cracking. A trace of certain types of silica sometimes will promote attack and the influence of this compound becomes even more important at still higher temperatures (corresponding to 500 lb. per sq. in. pressure and above). The action of the silica is complex and its influence will be treated in further detail later in this paper.

Several theories have been advanced to explain intercrystalline cracking in boiler steel. The one that best correlates available information is based upon a process of selective corrosion.

The Embrittlement Detector

A set of conditions that produce intercrystalline cracking in locomotive boilers has been outlined. If these ideas are correct, a testing device can be used to show whether or not a locomotive boiler water can cause this type of failure. Furthermore, the equipment can be attached directly to the boiler so that a portion of the water continuously pours into or through it, avoiding sampling with its attendant difficulties and errors. The "embrittlement detector", has been successfully developed for this purpose.

Fig. 2 shows the essential details of the embrittlement detector. The base of the detector is a rectangular block 5 in. long, 2¼ in. thick, and 3¼ in. wide, with a ¾-in. hole through which the

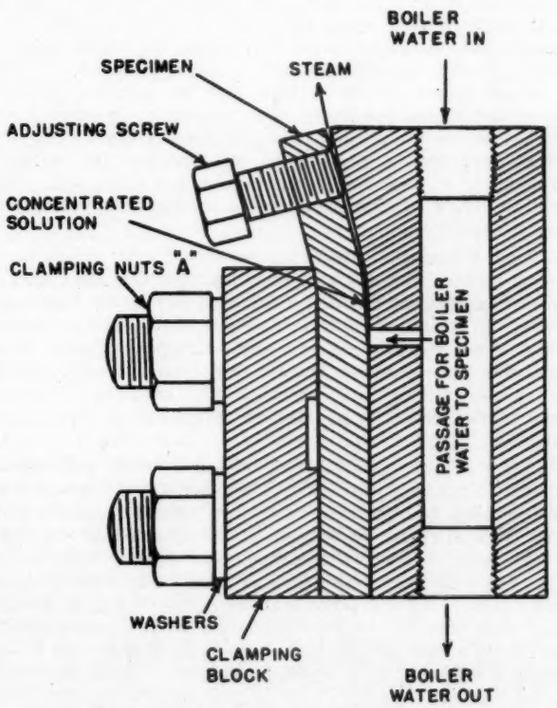


Fig. 2—Cross-section of the embrittlement detector

boiler water circulates. A machined groove receives the specimen. The latter is a steel bar 5 in. long, ¾ in. wide and ½ in. thick. (In the laboratory some specimens also have been used which are 5 in. long, 1¼ in. wide and ⅝ in. thick); bent and held in place by the nuts and clamping block. The unit is heated to operating temperature by the circulation of boiler water. A small hole conducts the water to the contact surfaces between the specimen and base block and by the correct setting of the clamping nuts and adjusting screw a very slow diffusion of steam is established out the end of the specimen. This diffusion is best detected by holding a cold glass or mirror over the end of the unit, and the most desirable adjustment will show only a slight haze of condensed steam. The concentrated solution forms under the bent area of the specimen and laboratory as well as plant tests show that cracking will result if the boiler water is embrittling.

Prevention of Intercrystalline Cracks

From the three factors known to be involved in the production of intercrystalline cracks it is evident that for new locomotive boilers two entirely different approaches might be employed for their elimination; i.e., to build the boilers in such a manner that they are not susceptible to cracking or to treat the water so that it will not cause cracking in any boiler.

In many ways the former of these has all the advantage, for the operator could then forget about embrittlement through the

life of the locomotive. On the other hand, if he relies on feedwater treatment, he must constantly and continuously have reports on chemical conditions. This is difficult for a railroad with hundreds of engines in service over a wide geographical area and raw water conditions subject to the vagaries of season and weather.

However, there are thousands of old locomotives in service and it is not yet certain that new boilers, because of construction limitations, are immune. Therefore, in spite of the difficulties, feedwater treatment frequently must be relied upon to prevent embrittlement. Sodium sulfate has sometimes been recommended for this purpose but it will be shown that its influence on locomotive boiler cracking is extremely doubtful. In many instances the data indicate that organic materials will give better results.

Construction of Boilers Resistant to Embrittlement

Embrittlement, in the very great majority of cases, has been found in the riveted seams of boilers. A direct remedy for the trouble would be to eliminate such seams, a practice now commonly followed in stationary boilers through the use of welded or forged drums. While welding has not yet been generally allowed for locomotive boilers, one test engine so constructed is reported to have operated successfully several years and may foretell very definite advances in this direction. Permitted use and adoption of welded seam construction is a direct and, judging from stationary experience, foolproof method that prevents this type of cracking.

A steel resistant to embrittlement would offer another solution. A number of years ago, Fry* reported that Izett steel had qualities superior in this respect to ordinary boiler flange steel. During the spring of 1939 the authors discussed this material with two engineers from the Fried. Krupp Company. It was their belief that in recent years it had been improved and now had greater resistance to embrittlement cracking. These engineers forwarded a small sample, designated as Izett II, for testing.

In three of four tests made of this steel in the embrittlement detector, no cracking was found. The other test showed some surface checking and three or four fine, extremely short cracks which, even after severe bending of the specimen at the end of the test, were only a few thousandths of an inch deep. Investigation for longer periods which is now being conducted, may crack this steel but it appears definitely superior to any American boiler plate that has been tested in the embrittlement detector. The results would indicate that study to develop for use in locomotives a steel that is resistant to embrittlement is not without promise.

A series of tests, comparable with those on the Izett steel, is now being conducted on a steel of American manufacture which was treated with aluminum and may be thoroughly deoxidized.

In locomotive construction low-alloy steels have been in common use in the past few years, generally with the express purpose of saving weight in order that the safe load on tracks and bridges may not be exceeded. These steels may have different characteristics in embrittlement tests from low-carbon boiler flange steel. The locomotive manufacturers, aware of this fact, have started cooperative work that may help to guide them in the selection of steel for new boilers.

Regardless of the steel used for construction, too much stress cannot be placed on careful design and shop practices. The experience of German engineers with stationary boilers aptly illustrates what may be accomplished by careful construction. From the time of the war until 1925 or 1926, embrittlement was as prevalent and annoying in Germany as it was in this country. The German engineers, in contrast to those in the United States, did not believe that water conditions were the only important factor, but instead that cracking was caused by poor boiler construction resulting from the haste and pressure of war conditions. With this idea in mind they improved their shop technique as much as possible and reported results indicate that this approach has been successful, greatly reducing and almost eliminating cracking in stationary boilers.

Some very interesting data have been accumulated from one railroad in the United States illustrating the unexpected manner in which serious embrittlement trouble may arise, and the difficulty of isolating the cause from the complex factors of design, workmanship, and chemical condition of the water that are known to be involved. A comparison of the number of engines in a given class that were embrittled, with the year in which they were built including only classes with 10 or more engines shows that of 602 engines built between 1902 and 1921 only 6, or one per cent, were cracked at the end of 1937. Individual classes are also interesting. For example class 1 with 211 engines suffered embrittlement in one, and class 5 with 150 engines did not have any cracked. The maximum percentage cracking is 20 for class 7.

Of 335 engines built between 1924 and 1930, not one per cent, but 120 engines or 36 per cent were cracked by 1937. In class 13, 34 boilers from a total of 45, or 76 per cent, were embrittled. Fifty-four per cent of the boilers in class 11 were cracked.

It seems reasonable to believe that there was some definite change, probably in engine construction or feedwater treatment, that caused the marked increase in cracking after 1921. The design and construction have been examined as closely as possible to determine what this might be. Changes were made from triple- to double-riveted circumferential seams and the efficiency of the longitudinal seams was also increased from 80 per cent to approximately 90 per cent, which resulted in the thickness of the boiler sheets being decreased. Riveting methods and pressures probably have gone through several changes over this long period; from hand to high pressure machine riveting and then back again to machine with care exercised to prevent excessive distortion of the plate. This may be a significant factor although this road has not yet discovered a riveting pressure that will prevent embrittlement. The steel used for the shell courses might also have altered over a period of years to be more susceptible to cracking. This argument is not too strong, however, for another railroad experienced its greatest difficulty between 1912 and 1926, indicating that some of the steel plate during this period was susceptible to cracking.

Up to 1926 only a small portion of the feedwater was treated to prevent scale and corrosion. At that time general conditioning was started on the road, using external treatment on some supplies and internal on others. This essentially eliminated scale formation as well as pitting and corrosion and also probably caused an increase in sodium hydroxide concentration in most of the boilers. It might be concluded that this was the important factor in causing embrittlement but *careful note should be taken of the fact that 335 locomotives, built prior to 1921, were still in operation in 1937 using the same water supply as the new locomotives and these do not have appreciable cracking difficulties.*

This clearly focuses the question as to why these older boilers can use an embrittling water without much difficulty. So far, as noted, differentiation between new and old boilers on the basis of construction factors alone has not been possible. Perhaps the use of the older engines, while the water formed scale, and was corrosive, created conditions in the seams that were unfavorable to embrittlement. Specifically, these might consist of deposits of calcium silicate or sulphate that prevented leakage. It is, however, difficult for the writers to believe that protection based on mechanical plugging to prevent leakage could exist over a period of years in a locomotive boiler.

While mechanical plugging of the seam is of doubtful significance, a thin film, chemically bonded to the steel surface, may have greater protective value. Detector specimens exposed to certain types of boiler water have been found covered with very thin and extremely adherent calcium or iron silicates. Even if leakage did occur such a film could separate the concentrated solution from the metal surface to prevent cracking. If this explanation is correct experimental demonstration may be possible.

Before treatment was in general use on this road, the locomotive boiler waters were quite corrosive, and caused a great deal of pitting and rusting. In the seams this may have formed an oxide coating through which it would be difficult to start cracking even in contact with the concentrated alkaline solution. Experimental testing of this possibility has been begun.

Clear cognizance should be accorded the fact that not all the engines manufactured since 1924 have cracked, in spite of the fact that they normally seem to operate with highly embrittling waters. In other words, the engines built prior to 1921 may be protected by scale or corrosion, but some engines built after 1924

* The Behavior of Materials Used in Boiler Construction When Subjected to Service Conditions. Ing. Fry. Kruppsche Monatshifte, V. 7, pp. 185-196 (November, 1926).

also can use embrittling waters without cracking. This may indicate differences of construction with important bearing on embrittlement, hidden even in engines of identical design. Not understanding these differences it remains for the locomotive boiler manufacturer to keep cold work stress at a minimum and yet to keep the boiler as free from leaks as possible.

Conclusions

Two of the three factors are independent of water conditions. Therefore, if sodium sulfate or any other compound is maintained in a boiler water and cracking does not occur it cannot be concluded that the water contained a protective agent. The boiler may have been so constructed that it would not have cracked in the absence of such treatment. This complex situation makes difficult the interpretation of statistical results and probably explains the widely different opinions regarding the action of sodium sulfate held by some engineers responsible for stationary boilers as compared to the opinions held in railroad practice.

Results from three different types of laboratory testing equipment have not shown that sodium sulfate will stop cracking of the specimens. This is true even under conditions that appear to represent closely those existing in a riveted seam. Data reported by the railroads would tend to support these results.

Waste sulfite liquor has been found to stop cracking of hot-rolled boiler-flange steel specimens in the detector tests. Sodium sulfate and sodium chloride were found to interfere with the protection shown by waste sulfite liquor. In spite of this limitation it may have played an important part in stopping one very prolonged case of embrittlement on one railroad. A second road, that has used this material for about two years, reports a sharp decrease in engines found leaking from cracks in road service. The use of waste sulfite liquor is not recommended without chemical control of the concentration in the boiler water or without use of the embrittlement detector to insure adequate treatment.

Any feedwater treatment used to prevent embrittlement cracking must be under continuous control. On the other hand, if a boiler is constructed which is resistant to embrittlement the danger is removed throughout its life. Welding the seams would be one means of accomplishing this purpose but at the present time such construction is not generally permitted in locomotive boilers. Another possibility would be the use of a steel resistant to intercrystalline cracks. Tests in the embrittlement detector show that Izett steel may be better in this respect than ordinary boiler flange steel.

Even with present methods a great deal can be done to prevent trouble when the locomotive boiler is being built. The importance of careful design, construction and shop practice cannot be overemphasized. Every care should be exercised to make the seam tight and to prevent excessive cold distortion of the metal.

Even though water treating methods to prevent embrittlement are complex and suffer definite limitations, the evidence from railroad operation indicates that their combination with good construction can reduce costly and dangerous embrittlement cracking.

Discussion

F. E. Russell, mechanical engineer, Southern Pacific, expressed his interest in the hypothesis set forth by the author to account for the intercrystalline weakening of a boiler material under conditions of high caustic concentration and stress. He considered the embrittlement detector developed in the investigation conducted under the joint support of the A. A. R. and other organizations for the solution of the embrittlement problem a valuable contribution. The hypothesis which requires a combination of slow leakage and stressed metal as well as caustic concentration is fortunate since it would be very expensive to eliminate the chemical factor alone. With the character of shop practice shown in some of the slides by the author, he said, it would not be surprising to have trouble of the kind indicated. Boiler sheets, he said, should be handled with care to protect the surface. This will go a long way to prevent all kinds of chemical attacks.

In fabrication there should be no drifting of rivet holes, reaming alone being employed. All lubricants and cuttings should be removed before riveting. No sharp-edged calking tools should be employed and inside calking should be light because the rivets are usually too far apart to support heavy calking. Riveting, he said, should preferably be hydraulic. With proper shop practice he expressed the opinion that the riveted locomotive boiler would approach the welded stationary boiler in freedom from chemical attack. On the Southern Pacific, he said, there have been no cases of embrittlement. This road uses the Zeolite treatment.

H. G. Miller, engineer tests, C. M. St. P. & P., was inclined to disagree with Mr. Russell that riveted construction can approach welded construction in freedom from the embrittlement difficulty. As long as joints are riveted the metal will be locally and unsymmetrically stressed.

The report was accepted with a rising vote of thanks.

Report of Arbitration Committee

During the year Cases 1772 to 1778, inclusive, have been decided and copies forwarded to the members. A copy of these decisions is made part of this report. A vote of concurrence in the decisions is respectfully requested by the committee.

It is the intent that repairs to foreign cars should be confined to the minimum, in order that car owner may have opportunity to perform as much of the maintenance work on his own equipment as possible. Revisions of Rules 1 and 16 are recommended which should clarify this feature.

The requirement in Paragraph (b-10) of Rule 3 which provides that brake shoes meeting requirements of A. A. R. Specification adopted in 1935 are required on all cars when received from owners, has been in the rules since January 1, 1936. No requests for extension of effective date beyond January 1, 1941, have been received. The committee feels sufficient time has elapsed to permit compliance and that no further extension of effective date is justified.

Attention is directed to modification of Paragraph (4) of Section (t) of Rule 3 issued in Supplement No. 1 in March, 1940, as result of letter ballot action, making the prohibition against acceptance of cars having arch bar trucks a general interchange requirement effective July 1, 1940.

A new paragraph is recommended under Rule 17 to provide a tolerance in width for application of running boards, which it is felt should be permitted due to variations in commercial widths as purchased from the manufacturer and shrinkage while in stock.

With the concurrence of the Committee on Couplers and Draft Gears, an addition to Rule 20 is recommended to provide for alignment of drooping couplers by the application of coupler shims in cases where coupler is not below prescribed minimum height from top of rail.

A revision of Rule 44 is recommended which provides a more explicit definition of the defects enumerated under this rule and which it is felt will facilitate inspection of cars in interchange.

Recommendation was submitted in the 1939 report and approved, to provide separate depreciation for tanks renewed on existing underframes and trucks for use in settlement for destroyed tank cars. Investigation discloses a number of existing tanks have been mounted on new underframes and new trucks. Therefore, a further modification of the rule is recommended to extend the same principle to this reverse operation.

Studies are being conducted on a number of representative railroads of the overhead allowances now used in formulating the A. A. R. labor rate. If it develops modification is necessary as result of this study, with the approval of the General Committee the revision will be included in the 1941 Code.

The committee does not feel that any of the modifications included in its report necessitate submission to letter ballot.

All recommendations for changes in the Rules of Interchange submitted by members, railroad clubs, private car owners, etc., have been carefully considered by the committee and, where approved, changes have been recommended.

Attention is again directed to the fact that the Arbitration Committee will not consider questions under the Rules of Interchange unless submitted in the form of Arbitration Cases as per Rule 123.

Freight Car Rules

Rule 1

The committee recommends that this rule be modified, effective August 1, 1940, as follows:

Proposed Form: Rule 1. (a) Each railroad is responsible for the condition of all cars on its line, and must give to all equal care as to inspection *and lubrication.*

(b) Repairs should be made by car owner insofar as may be practicable. In the event a foreign car requires repairs account of owner's defects, *such repairs may be made subject to the following conditions:*

1. Repairs to loaded cars must be confined to the minimum necessary for the safety of cars, lading and trainmen.

2. Repairs to empty cars located at points where there is a direct connection with car owner, or where there is an intermediate switching line to car owner and cars are acceptable to such switching line for movement to car owner, must be confined to the minimum necessary for safety of trainmen and safe movement of car to home line.

3. Repairs to empty cars at other points must be confined to the minimum necessary for safety of car and trainmen, except where car is to be loaded on repairing line, in which event paragraph (b-1) applies.

4. Empty cars of lower loading classification may not be repaired for Class A loading without car owner's consent.

5. Cars requiring repairs so extensive as to be reportable under Rule 120, *shall* be handled in accordance with that rule.

Reason: To clarify the intent that repairs to foreign cars should be confined to the minimum and to give car owner an opportunity to maintain his own equipment.

Rule 2

The committee recommends that first paragraph of Section (b) of this rule be modified as follows:

Proposed Form: (b) Cars loaded with explosives *and other dangerous articles* must be handled in accordance with the *I. C. C.* Regulations.

Reason: The same penalties are provided for violation of these Regulations with respect to "other dangerous articles" enumerated therein, as for violations involving explosives.

The committee recommends that Paragraph 2 of Section (f) of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: 2. All truck defects on foreign cars; except defective metal bolsters or center plates cast integral therewith, defective truck sides and metal transoms, defective non-A. A. R. standard journal boxes where the A. A. R. Standard is not a proper substitute. *However, where a loaded car is equipped with type of trucks prohibited under Rule 3, transfer authority is proper.*

Reason: To relieve receiving line from expense of transfer on cars which are prohibited in interchange under Rule 3.

Rule 3

The committee recommends that effective dates for various requirements in the present rule, as listed below, now set at January 1, 1941, be extended to January 1, 1942:

Section (b), Paragraph (8)—Bottom rod and brake beam safety supports.

Section (b), Paragraph (9)—Braking power.

Section (c), Paragraph (11)—Couplers having 5 by 5 inch shanks.

Section (j), Paragraph (2)—Journal boxes, repacking of.

Section (t), Paragraph (3)—Application of welded side frames having "T" or "L" section compression or tension members.

Section (u), Paragraph (4)—Class E-3 cars not to be accepted from owner.

Reason: The present situation justifies these extensions.

The committee recommends that no further extension beyond January 1, 1941, be granted for effective date of requirement contained in Paragraph (10) of Section (b) of this rule, specifying that cars must be equipped with A. A. R. 1935 Specification brake shoes to be acceptable from owner.

Reason: This requirement has been in the rules for several years and it is felt sufficient time has elapsed to permit compliance therewith.

The committee recommends that Paragraph (3) of Section (s) of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: (s-3) Stenciling: Date built new, month and year, or badge plate giving this information, required on all cars. Date rebuilt, in addition to date built new, month and year, or badge plate giving this information, required on all cars rebuilt on or after July 1, 1928. From owners. In event tank and underframe of tank cars are built at different times each must bear distinctive dates, the date on underframe to be date *underframe (including trucks) was built new.*

Reason: To harmonize with change in Paragraph A-5 of Rule 112.

Rule 4

The committee recommends that a new second sentence be added to Paragraph (a) of this rule, effective August 1, 1940, to read as follows:

(a) In the case of damage to a car for which the delivering line is responsible, such line must, at the first available inspection point, attach defect card to cover. *Car owner should repair such defect-carded defects and remove defect car the first time car is shopped to car owner's repair track or repair shop.* On cars extensively damaged, etc. (no other change).

Reason: Defect card damage should be repaired promptly.

The committee recommends that second paragraph of Section (b) and third paragraph of Section (f) of this rule be modified, effective August 10, 1940, as follows:

Proposed Form: (b-2) If cars are offered in interchange with damage other than referred to in Paragraph (b-1), on which there is conclusive evidence of unfair usage, the receiving line shall require that defect card be attached to car, per Rules 2 and 14. Damage to or beyond extent specified in Sections (c) to (h), inclusive, *except when due to corrosion,* will be classified as unfair usage for which defect card shall be issued in interchange.

(f-3) Metal side and end sheets: Holes through the thickness of the metal to an extent exceeding three inches measured in any direction, except when due to shifting of loads from within the car.

Reason: To clarify the intent. Damage due to corrosion should be owner's responsibility.

The committee recommends that Paragraph (2) of Section (c) of this rule be modified, effective August 1, 1940, to read as follows:

(c-2) Metal posts, metal braces and metal sheets: Bent inwardly 1½ inches or more. Bulb portion only of pressed steel parts, or flanges only of structural *or pressed steel* shapes, when bent, regardless of extent, will not be cardable except where necessary to repair under conditions referred to in Paragraph (3).

Reason: Flanges of pressed steel parts are entitled to same protection as flanges of structural shapes.

The committee recommends that a new last sentence be added to first note following Section (d) of this rule, effective August 1, 1940, to read as follows:

Note.—It is understood that adjoining raked sheathing if not split or broken will not be cardable unless raked into tongue, except that on refrigerator cars sheathing boards raked to bottom of bead but not into tongue will also be cardable if they adjoin (in consecutive order) the board raked into tongue, broken or split. Sheathing damaged due to use of bar for closing side door is not cardable. *Damaged or missing short sheathing boards under doorway are not cardable.*

Reason: These defects are not considered detrimental and frequently do not result from unfair usage.

The committee recommends that Paragraph (1) of Section (f) of this rule be modified, effective August 1, 1940, to read as follows:

(f-1) Metal posts, metal stakes, metal braces, metal top chord angles, or their substitutes: Bent inwardly four inches or more. Bulb portion only of pressed steel parts, or flanges only of structural *or pressed steel* shapes, when bent, regardless of extent, will not be cardable except where necessary to repair under conditions referred to in Paragraph (2).

Reason: Flanges of pressed steel parts are entitled to same protection as flanges of structural shapes.

The committee recommends that a new second note be added to Paragraph (6) of Section (f) of this rule and issued in the next supplement, to read as follows:

Note.—Bent metal side and end sheets are cardable only when bent in connection with cardable bent posts, stakes, braces, metal top chord angles, or their substitutes.

Reason: To clarify the intent.

The committee recommends that first and second paragraphs of Section (k) of this rule be modified as follows:

Proposed Form: (k) (1) When a car is received home with unfair usage defects covered by defect card bearing notation "Home for Repairs," and it develops that there are associated defects due to unfair usage which evidently occurred at same time, joint inspection *as outlined in Rule 12,* may be made within

90 days after first receipt of car home, and joint inspection certificate issued showing list of defects covered by the defect card as well as list of additional associated unfair usage defects. Such joint inspection certificate shall be forwarded to the road issuing defect card which shall issue additional defect card to cover.

(2) When a car is received home covered by defect card not bearing notation "Home for Repairs," and it develops there are associated, concealed defects due to unfair usage (except interior fire damage per Rule 32, Section k), which evidently occurred at same time, joint inspection *as outlined in Rule 12,* may be made within 90 days after first receipt of car home, and joint inspection certificate issued showing list of defects covered by the defect card as well as list of the additional associated concealed unfair usage defects. Such joint inspection certificate shall be forwarded to the road issuing defect card which shall issue additional defect card to cover.

Reason: To harmonize with the provisions of Rule 12.

Rule 9

The committee recommends that a new requirement be added to this rule, effective August 1, 1940, with respect to information which must appear on billing repair cards, opposite heading "General," to read *"Empty or loaded car."*

Also, that the billing repair card forms (pages 267 and 268) be revised to include space for showing this information in upper right-hand corner.

Reason: This information is necessary in connection with revision of Rule 1.

Rule 16

The committee recommends that first paragraph of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: Rule 16. Any car having defects which render it unsafe, may be repaired, subject to provisions of Rule 1.

Reason: To harmonize with revised Rule 1.

Rule 17

The committee recommends that a new Note 7 be added to the brake beam substitution table under Section (e) of this rule, to read as follows:

Note 7.—Insofar as substitutions, charges and credits are concerned, the No. 4 brake beam shall take the status of the No. 3 beam.

Reason: It is considered the No. 3 beam is ample in strength and can consistently be classified as a proper substitute for the No. 4 beam.

The committee recommends that present Section (k) of this rule be relocated as new Section (l); also, that a new section to be designated as Section (k) be added, to read as follows:

Proposed Form: (k) *In the application of running boards, a difference in width of ¼ in. (plus or minus) from that standard to car, will be considered as proper repairs, providing the boards applied do not violate safety appliance requirements.*

Reason: Due to shrinkage and account of variations in commercial widths as purchased from the manufacturer, it is felt this tolerance should be permitted.

Rule 19

The committee recommends the effective date for tenth item under this rule, now set at January 1, 1941, be extended for one year, to read as follows:

Welded cast-steel truck side frames having "T" or "L" section compression or tension members, on and after January 1, *1942.*

Reason: To harmonize with extension recommended under Rule 3.

Rule 20

The committee recommends that Paragraph (f) of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: (f) *When coupler within prescribed height limits is found to be drooping (one inch or more with key attachment, or ¾ inch or more with riveted attachment), same should be corrected as provided in Paragraph (b). Coupler droop is the distance which center face of line of coupler butt.* When couplers or draft gears are removed, replaced or renewed for or on account of repairs, and coupler height is within prescribed limits, the couplers and draft gears should be properly aligned as provided in Paragraph (b).

Reason: To provide for alignment of drooping couplers when coupler is not below prescribed minimum height from top of rail. This recommendation has the concurrence of the Committee on Couplers and Draft Gears.

Rule 22

The committee recommends that a new first paragraph be added to this rule, to read as follows:

Rule 22. *Damaged longitudinal sills, or parts thereof, must be repaired, or spliced, in accordance with the following specifications where practical and more economical than renewal. In such cases, if sills or parts thereof are renewed, charge may not exceed the cost of splicing.*

Reason: To confine repairs to minimum expense necessary in accordance with recognized general practice.

Rule 23

The committee recommends that effective date of requirement prohibiting the welding of cast-steel truck side frames having "T" or "L" section compression or tension members, now set at January 1, 1941, be extended to January 1, 1942.

Reason: To harmonize with extension recommended under Rule 3.

Rule 44

The committee recommends that this rule be revised as follows:

Proposed Form: (2) Composite *wood* and steel underframe cars. When five or more steel or *wood* longitudinal sills are damaged *within the space between bolsters,* providing three or more are broken entirely new at point of breakage.

(3) All-steel underframe cars having but one steel center *sill. When broken wholly or in part within the space between bolsters, or* when bent *within such space* in excess of 2½ inches. *Where failure of such sill is* due to progressive fracture back of body bolster, or failure of cast-steel extension (draft arm), *it will be owner's responsibility.*

(4) All-steel underframe cars having two or more longitudinal sills.—When two center sills, *within the space between bolsters are:*

(*a*) *Both broken wholly or in part, or*

(*b*) *When each is bent in excess of 2½ inches, or*

(*c*) *When one is broken wholly or in part, and the other is not broken but is bent in excess of 2½ inches.*

(5) (Vacant.)

Note A. Draft members, wood or steel, extending from end sill to end sill and used to reinforce center sills, are not longitudinal sills.

Note B. The bending of steel center sills in excess of 2½ inches does not refer to sagging or bowing, but to definite buckling or abrupt bends. The term "between bolsters" means from rear edge of body bolster at one end of car to rear edge of body bolster at opposite end of car.

Note C. When the damage is confined to the steel center sills within the space from end sill to bolster, car owner will be responsible, providing after investigation it is found that car was not subjected to unfair handling as provided by Paragraphs (a), (b), (c), (e), (f), (o), or (q) of Section (10) of Rule 32.

Reason: To provide a more explicit definition of the defects and a more practical method of determination in interchange inspection.

Rule 49

The committee recommends that last sentence of Section (a) of this rule be relocated as new Section (b) and revised, present Sections (b), (c), and (d) to be relettered as Sections (c), (d) and (e), as follows:

Proposed Form: (b) Where receptacle is used, same should be in accordance with A. A. R. Recommended Practice specifications, applied one per car, preferably located *on outside of car as specified in following Paragraphs (1), (2) and (3), not more than 5 ft. 6 in. from top of rail. However, if located underneath the car, it should be applied on cross bearer nearest center of car, not more than 12 inches from side sill. Cars having fish belly side sills should not have the receptacle underneath the car.*

Present paragraphs (1), (2) and (3) of Section (a) to be relocated as paragraphs (1), (2) and (3) under new Section (b).

Present Sections (b), (c) and (d) to be relocated as new Sections (c), (d) and (e).

Reason: To definitely prescribe location for defect card receptacle, in order to conserve time in transportation yards.

Rule 60

The committee recommends that air brake markings be modified to show *reporting marks* instead of *initials* of roads, by eliminating the word *"road"* shown on the cylinder in cuts on pages 122 and 123 and changing caption to read "Stencil here *reporting marks* of road" instead of "Stencil here *initials* of road."

Reason: To reduce stenciling. This recommendation is concurred in by the Committee on Brakes and Brake Equipment.

The committee recommends that a new Paragraph (n) be added to this rule, effective August 1, 1940, to read as follows:

(n) Charge for cleaning of AB type freight brake equipment within time limits specified by this rule, is not permissible account renewal of pipe and pipe fittings, duplex release valve parts shown in Item 27 of Rule 111, vent protector, brake cylinder, brake reservoir, combined dirt collector and cut-out cock, branch pipe tee, retaining valve, or parts of these items. Charge for separate COT&S of emergency or service portion is not permitted.

Reason: COT&S of operative AB brake equipment is unnecessary in connection with renewal of above items. This recommendation has the concurrence of the Committee on Brakes and Brake Equipment.

Rule 75-A

The committee recommends that first paragraph of this rule be modified in the next supplement, as follows:

Proposed Form: Rule 75-A. Combination tread defects—shelled out, flat spots, brake burn comby spots: Cast-iron wheels having *three* or more defects not more than three inches apart and extending circumferentially on tread for a distance of 12 in. or more, etc.

Reason: To clarify the intent.

Rule 78

The committee recommends that second paragraph of this rule be modified as follows:

Proposed Form: Rim, broken—cast-iron and cast-steel wheels: (a) If the width of tread measured from flange at a point 5/8 in. above tread, is 3½ in. or less (see Fig. 5); or, (b) If width of tread, measured from flange at a point 5/8 *in.* above tread, is *3¾ in. or less* and the fracture through rim inclines inwardly toward plate (see Fig. 5-A). Measurements to be made with gage shown in Fig. 1, and applied as shown in Figs. 5 and 5-A. See Paragraph 115 and Figs. 97 to 99 in Wheel and Axle Manual.

Reason: To clarify the intent and harmonize with Rule 82 as recommended by the Committee on Wheels.

Rule 98

The committee recommends that first sentence of Paragraph (5) of Section (c) of this rule be modified as follows:

Proposed Form: (c-5) Serviceable experimental cored hub wheels marked "A. A. R. X." when removed from service on account of defect in axle or mate wheel, shall be credited as scrap except when removed on account of Rule 32 *or Rule 84* condition in which event second-hand credit must be allowed for such undamaged wheel *or wheels.*

Reason: Car owner is entitled to protection in cases of wheels removed due to cut journals.

Rule 104

The committee recommends that Item 11—Journal Boxes under Section (1) of this rule be eliminated, Item 16 reading "Truck sides" be modified to read "Truck sides, U section," and last paragraph and note be relocated as new notes under new Section (m) and modified; the new section and notes to read as follows:

(m) The following items of material, when applied in repairs to owner's defects or on authority of defect card, must, if secondhand, be charged at 30 per cent of gross value new, less credit for part removed:

1. Journal boxes.

2. Truck sides, "T" and "L" section.

Note 1.—When items *specified in Sections (l) and (m)* are applied, the billing repair card must show whether new or secondhand. If secondhand, the material charge must be shown in "net price" column on billing repair card. If defect card covering labor and secondhand material is issued account of wrong repairs to owner's defects, in the correction thereof bill on authority of defect card must be confined to secondhand value, regardless of whether new or secondhand material is applied. Such defect cards should so specify if secondhand material is applied.

Note 2.—Where Rule 101 quotes net price, 50 per cent of such net price for *items in Section (l), and 30 per cent for items in Section (m),* shall be used and no credit allowed for scrap.

Reason: Due to elimination of arch bar trucks and accumulation of journal boxes as result thereof, and obsolescence of the "T" and "L" section side frames, it is felt the charge for such secondhand parts should be reduced.

Rule 108

The committee recommends that 23rd item under Section (a) of this rule (which prohibits labor charge) be modified as follows:

Proposed Form: Release lever bracket or support, straightened on car.

Reason: No charge is now permitted for straightening release lever bracket support. It is felt the same principle should consistently be extended to cover the release lever bracket.

Rule 112

The committee recommends that Paragraph 5 of Section A of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: A-5. Age of car shall be determined by subtracting year and month in which car was originally built, or rebuilt, from year and month in which car was destroyed, which will give the life in years and months. No fractional part of a month shall be considered. The age of trucks shall be the same as that of the car body. *However,* where new or secondhand tank is applied to a tank car subsequent to original date car was built; *or secondhand tank is applied to complete new underframe (including attachments) and complete new trucks (except that the following items of secondhand material may be used; couplers, draft gears, wheels, axles and AB brakes exclusive of pipe and pipe fittings), and providing that car complete including secondhand details conforms with all A. A. R. interchange requirements for new cars in effect at date of construction;* depreciation on such tank shall be computed from date tank was built new, and depreciation on remainder of car shall be computed from date *underframe (including trucks) was built new.*

Reason: Effective August 1, 1939, Rule 112 was modified to provide separate depreciation for tanks renewed on existing underframes and trucks. The same principle should consistently be extended to the reverse operation.

Defect Card Form

The committee recommends that the words *"Must not have carbonized back" be added to the defect card form on page 260, similar to the billing repair card form.*

Reason: The use of the carbonized back is objectionable for filing purposes. As a measure of economy and to promote uniformity.

Passenger Car Rules

Rule 4

The committee recommends that the effective date of second paragraph of this rule, with reference to equipping all-steel or steel underframe cars with cardboards or suitable receptacle for the accommodation of defect and joint evidence cards, now set at January 1, 1941, be extended to January 1, 1942.

Reason: The present situation justifies this extension.

Rule 9

The committee recommends that present note following Section (f) of this rule be eliminated and a new Section (g) added, effective August 1, 1940, as follows:

Proposed Form: (f) Note. (Vacant.)

(g) (1) Air Conditioning Equipment. Labor and material expense for ice, water, lubricants, steam, fuel for internal combus-

tion engines, and cost of precooling cars, including electric current supplied, also labor of all daily and periodic testing and inspecting and all other items of servicing.

Proposed Form: (2) Cost covering the above shall be agreed to by the parties involved and be charged only at the originating terminals of established line. Ice furnished ice-activated cars at intermediate terminals is also chargeable to the line.

(3) All repairs made are chargeable direct to car owner, including charging and flushing of batteries, and Freon or similar refrigerant supplied.

Reason: The line service items enumerated are special expense of the originating terminal that should be borne by all parties to the line on a prorata mileage basis.

Rule 10

The committee recommends that Item No. 6 of this rule be modified, effective August 1, 1940, as follows:

Proposed Form: Rule 10. Interchange Service expense items to be assumed by handling line, are as follows:

6. Air conditioning equipment: *Expense items outlined in paragraph (g) of Rule 9 shall be assumed by handling line.* All repairs made are chargeable *direct* to the car owner, including charging and flushing of batteries, *and Freon or similar refrigerant supplied.*

Reason: To harmonize with recommended revision of Passenger Rule 9.

The report was signed by W. H. Flynn (chairman), general superintendent motive power and rolling stock, N. Y. C.; J. P. Morris (vice-chairman), mechanical superintendent, A. T. & S. F.; R. G. Bennett, general superintendent motive power, Pennsylvania; A. E. Smith, vice-president, Union Tank Car Co.; J. A. Deppe, superintendent car department, C. M. St. P. & P.; L. Richardson, mechanical assistant to vice-president and general manager, B. & M.; G. E. McCoy, assistant general superintendent car equipment, C. N. R., and M. F. Covert, general superintendent of equipment, General American Transportation Corp.

In presenting the report Chairman Flynn referred to the revision of paragraph 4, Section (b), of Rule 1 and presented a note defining "lower loading classification" which, he said, was to be included in the revision. The note reads as follows: "Cars of 'lower loading classification' refers to cars the general condition of which is such that extensive repairs would be required to place them in suitable condition for Class A loading. Miscellaneous minor repairs to damaged portions of flooring, roofing, sheathing, lining or doors on cars required for, and which are otherwise suitable for Class A loading, is not prohibited."

The report was accepted.

Report on Labor and Material Prices

In order that the rules may currently provide an equitable basis for inter-road billing, the committee continued the work of analyzing material, labor and new equipment costs in A. A. R. Interchange Rules 101, 105, 107, 111 and 112 of the Freight Car Code, and Rules 21 and 22 of the Passenger Car Code, with a view of determining and recommending necessary changes to be made in the next supplement to the current Code.

Freight Car Rules

Rule 101

All miscellaneous material prices in Rule 101 were rechecked as of March 1, 1940, quotations submitted by the purchasing agents of the ten selected railroads, representing 39 per cent of total freight car ownership in the United States and Canada, showing a slight downward trend in material markets as indicated by detail recommendations for revisions shown under this rule.

The allowance of two per cent which has been added to material quotations in the past to represent interest on stock investment was based on a turnover every four months at six per cent per annum. Investigation discloses that under present conditions the more common items of car repair material are turned over every two months. It is recommended, therefore, the allowance be reduced to one per cent effective August 1, 1940, and material prices listed under this rule have been so computed.

A study is under way on nineteen selected railroads representing all portions of the United States and Canada, through the Purchases and Stores Division, to ascertain if the present ten per cent allowance for store expense used in the make-up of A. A. R. material prices, is equitable. If any modification is found necessary, revision will be made and included in the Rules effective January 1, 1941.

New Item 129-C is added, to provide charge for Type E coupler knuckle lock made of high tensile steel.

One new conditionally approved type of draft gear, Waugh-Clark 150-B, has been added to Section I of the draft gear table. One additional type has been added under the obsolete classification in Section III.

Rule 105

Interpretation No. 1 to this rule has been modified to reduce from 15 to 12 per cent the allowance that may be added to the factory price of manufactured articles to cover store expense, interest on stock investment and freight haul, to harmonize with formula used in setting up A. A. R. material prices appearing in other rules.

Rule 107

Based upon studies recently conducted, the allowances for bolts under Items 30 and 31, and rivets under Items 291 and 292, have been materially reduced.

New Item 47-B and note are added to provide labor charge for coupler shims described in Figs. 2 and 3 of Rule 20 and to clarify the intent that the charge for removal and replacement of couplers in order to apply any of the various types of shims shown in Rule 20 is not proper.

Items 93, 147 and 158 have been modified to clarify the intent and provide charge for drive screws and floor rack stringers.

Item 98 is modified to increase the allowance for jacking loaded cars, based on time studies in the field conducted under the direction of the committee.

Item 281 is modified to provide a more equitable allowance for annealing parts which have been welded, as result of time studies in the shops of railroads and private car lines represented on the committee.

Items 280 and 294, also as result of studies made in various railroad and private line shops, have been modified to provide a more equitable basis of charging for repairing and straightening of parts off car.

The committee has arranged to conduct time studies in the field of a number of operations, principally truck repairs, to ascertain if present allowances appearing in this rule are equitable under present day conditions on modern repair tracks. Any adjustments necessary will be incorporated in the Rules effective January 1, 1941.

Rule 111

No modifications are recommended in this rule.

At the time studies were conducted on which the present allowance for AB brake equipment was formulated, investigation was necessarily confined to the initial cleaning operation. The second cleaning cycle has now been reached for a considerable number of such brakes, which undoubtedly will involve the renewal of an increased number of detail parts. Arrangements have been made to conduct studies on various railroads of the cleaning operation, to include a reasonable percentage of brakes due for second cleaning, and any adjustment necessary will be made in the 1941 Code.

Rule 112

Recommendations are made in this rule respecting reproduction pound prices of new freight cars of all classes, in order that Supplement of August 1, 1940, may reflect 1939 costs in lieu of figures shown in the present Code. New prices recommended are based on costs of 16,889 freight cars constructed during the year 1939.

The table listing all-steel tank cars has been modified to provide a more definite separation between insulated and non-insulated tank cars, and inclusion of the higher pressure requirement cars with other special types to be settled for on reproduction cost basis.

Passenger Car Rules

Rule 21

Item 26 modified and first note following eliminated to provide an allowance for turning wrought-steel and steel-tired wheels equipped with certain types of roller bearings which necessitate additional work in order to perform the operation.

Rule 22

Material prices were rechecked on basis of quotations as of March 1, 1940, showing a slight downward trend as indicated by detail recommendations for revisions shown under this rule.

Note following Item 49 modified to clarify the intent.

It is the intent of the committee to investigate labor and material costs again in October and if sufficient change develops, necessary revisions will be made and inserted in the rules effective January 1, 1941.

[The changes recommended in the existing rules are shown in detail in the report.]

Supplementary Report

[Note: This supplementary report, presented at the time of the meeting, not only recommends additional changes but alters, in some respects, the recommendations of the original report, as abstracted above—Editor.]

As a result of time studies just completed on five railroads in sufficient volume to warrant modification of a number of labor allowances, your Committee recommends additional changes in Rules 101, 107, 111 and Passenger Rule 21.

Freight-Car Rule 101

The labor allowance for renewal of dust guards has been absorbed in the allowances for wheels, truck sides and journal boxes. Accordingly, the wording of Item 169-A is modified to indicate an applied price and the labor allowance in Rule 107 eliminated.

Freight-Car Rule 107

Item 20 covering renewal of brake beams, is modified, and new Item 20-A added, to provide separate allowances for beams renewed separately versus those renewed in connection with truck bolster, truck side or wheels in unit type trucks, which it is felt will provide a more equitable method of charging.

Item 102 covering labor charge for journal box dust guards is eliminated, account labor absorbed in the allowances for wheels, truck sides and journal boxes.

Items 239, 240, 241 and 265 covering stenciling operations are clarified, allowances modified and the latter two items relocated as news Items 240-A and 241.

Item 256 covering renewal of truck springs, caps or shims, has been modified to include necessary jacking for this operation and separate allowances set up for empty and loaded cars.

Based upon the studies recently conducted, in addition to the above mentioned items, modifications are recommended in the allowances under Items 14, 42, 43, 44, 45, 48, 49, 138, 143, 153, 254, 255, 267, 268, 269, 270 and truck combination labor charges under Items 317 to 325 inclusive.

Freight-Car Rule 111

Based upon studies recently conducted, which included a representative number of valves undergoing second period attention, the allowance in Item 15 for COT&S of AB freight brake equipment is materially reduced.

Passenger-Car Rule 21

Item 25-B is modified to reduce allowance to be deducted when wrought-steel wheels are removed and dismantling operation is unnecessary.

The report was signed by A. E. Calkins (chairman), superintendent of equipment, N. Y. C.; A. E. Smith (vice-chairman), vice-president, Union Tank Car Co.; J. D. Rezner, general car foreman, C. B. & Q.; P. Kass, superintendent car department, C. R. I. & P.; T. J. Boring, general foreman, M. C. B. Clearing House, Pennsylvania; H. H. Boyd, assistant chief motive power and rolling stock, Can. Pac., and A. H. Gaebler, superintendent car department, General American Transportation Corp.

The report was accepted.

Report on Specifications for Materials

During the past year this committee has reviewed the material specifications, giving consideration to comments and criticisms submitted by the members of the association, and others.

The following revisions are submitted for your consideration:

1—Specifications M-102-34, forgings carbon steel, annealed and unannealed.—In order to clarify interpretation, changes to be made as follows: Page 1, Sec. 1. Scope.—(a). Last sentence to be revised as follows: "Grade 3 forgings are generally used for locomotive axles, side rods, crank pins, guides, etc." Page 1, Sec. 1. Scope.—(c). To be revised as follows: "Unless otherwise specified, Grades 1 and 2 forgings will be furnished unannealed, and Grade 3 forgings will be furnished annealed." Page 2, Sec. 7. Chemical Composition—Grade 3 requirement for Manganese: change 0.50—0.90 per cent to 0.60—0.90 per cent.

2—Specifications M-108-37, boiler tubes, lap-welded and electric resistance welded seamless steel and lap-welded charcoal iron.—This specification has been revised as a whole, and the recommended revised specification is identified as Exhibit A (not shown in the present abstract of the committee's report). The principal changes are as follows: (a) To conform to present practice in the steel industry, the tables have been modified on the basis of wall thickness expressed in decimals of an inch in place of Birmingham wire gage. (b) At the recommendation of the Committee on Locomotive Construction, the scope of the specifications has been changed to include dry pipes and steam pipes for locomotives, to dimensions shown in Table II, to replace the figures for dry pipes shown in the Manual, Sec. F, page 6A, 1924.

3—Specifications M-109-36, structural rivet steel and structural rivets.—Specifications M-110-36, boiler rivet steel and boiler rivets. Consolidation of specifications M-109 and M-110 is recommended and draft of the proposed consolidated specification, designated as M-110-40, is identified as Exhibit B (not included in this abstract of the committee's report).

4—Specifications M-119-34, galvanized sheets.—Changes to be made as follows: Page 2, Sec. 5 (c) Table I. Insert U. S. standard gage No. 15; nominal thickness of base sheet, .070 in.; weight of galvanized sheet, ounces per sq. ft., 45.1 min., 47.5 nominal, 49.9 max.; minimum weight of coating, 1.75 ounces per sq. ft.

5—Specifications M-302-37, refined wrought iron bars.—Changes to be made as follows: Page 2, Sec. 5 (a): Heading of second column to be changed to read "Round, Square and Hexagonal Bars 1⅝ in. and up to but not including 2½ in. in diameter or thickness." Add small letter "c" in third column opposite tensile strength requirements for both Grades A and B. Change present footnote reference "a" to read, "Bars from ½ in. to ⅞ in. in diameter will be accepted if the elongation in 8 in. is not less than 25 per cent for Grade A, or 22 per cent for Grade B material"; and add additional sentence to footnote reference "a" to read: "Bars under ½ in. in diameter will be accepted if the elongation in 8 in. is not less than 22 per cent for Grade A and for Grade B material." Add footnote reference "c" to read, "c When the sectional area exceeds 12 sq. in. the allowable minimum tensile strength shall be 45,000 lb. per sq. in."

6—Specifications M-603-38, hose, air, gas and oxygen, wrapped and braided.—Changes to be made as follows: Page 4, Sec. 15 (b) to be revised as follows: "(b) For braided hose, the inside diameter may vary either way from that specified by not more than 3/128 in. for the ¼ in. size; 1/32 in. for sizes larger than ¼ in. up to and including ¾ in.; and by not more than 1/16 in. for larger sizes."

7—Specifications M-904-36, renovated car oil.—This specification as submitted by the Joint Sub-Committee on Journal Box Lubricating Materials has been studied and approved, and it was agreed that the Committee on Lubrication should include it in that committee's annual report.

This committee recommends that the above revisions in specifications be approved for submission to letter ballot.

The report was signed by T. D. Sedwick (chairman), engineer of tests, C. R. I. & P.; E. E. Chapman (vice-chairman) mechanical assistant, A. T. & S. F.; Frank Zeleny, engineer of tests, C. B. & Q.; H. G. Burnham, engineer of tests, Nor. Pac.; H. P. Hass, engineer of tests, N. Y., N. H. & H; J. R. Jackson, engineer of tests, Mo. Pac.; H. G. Miller, engineer of tests, C. M. St. P. & P.; J. W. Hergenhan, assistant engineer, test department, N. Y. C.; L. B. Jones, engineer of tests, Penn.; C. B. Bryant, engineer of tests, Southern; and W. R. Hedeman, engineer of tests, B. & O.

The report was accepted and submitted to letter ballot.

Locomotive Construction

Design of Fundamental Parts of Locomotives

Wheel Centers of the Thin Wall Type

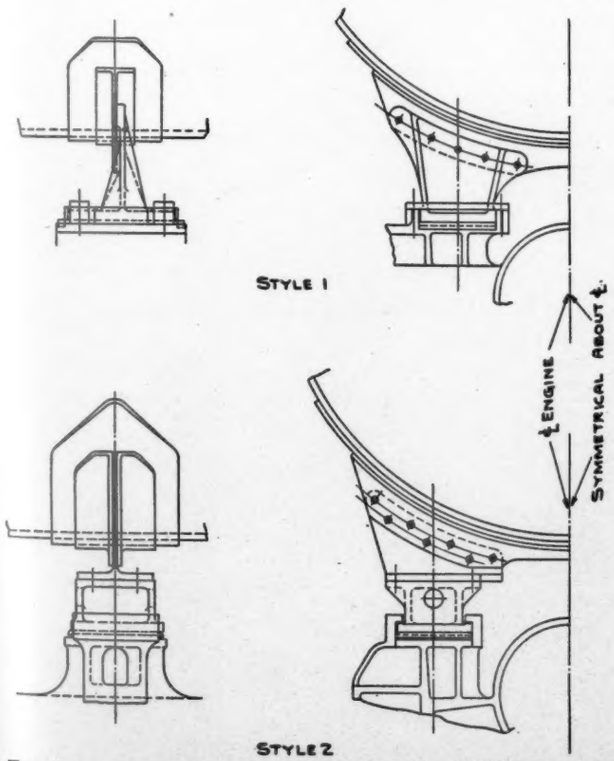
The Committee decided to continue report made last year and show defects that have developed in the various types of wheel centers.

Report following shows all defects from date of application up to April 30, 1940. This information is given for the benefit of member roads as well as benefit of manufacturers in discovering defects in designs and making necessary corrections for overcoming same.

[The report includes tabular details of failed wheel centers. A summary of such failures appears in Table I—Editor.]

Table I—Summary of Failures of Thin-Wall Driving Wheel Centers

Manufacturer	Total number of wheels in service	Total defective	Per cent defective
No. 1	1,086	77	7.0
No. 2	8,499	52	.61
No. 3	340	11	3.2
No. 4	1,267	17	1.3
No. 5	833	4	.48



Two designs of a single boiler support located midway between the cylinders and the front furnace bearer

Multiple Bearing Crossheads

The sub-committee was requested to prepare proposed designs to be added to the Manual as recommended practice for multiple bearing crossheads.

Two different designs are shown in the report and it is the intention of the committee to have both placed in the Manual so that individual roads can select the type desired.

It is recommended that this be submitted to member roads by letter ballot for inclusion in the Manual as recommended practice.

Furnace and Firebox Support and Boiler Waste Sheets

In 1938 a test was made jointly by the Baldwin Locomotive Works and the General Steel Castings Corporation on a locomotive then under construction in the Baldwin plant having one-piece cast-steel bed. This test was made to determine the effect of waist sheets or other attachments between frame and boiler from the front of the firebox to smoke box connection.

The sub-committee went over report of this test and for the information of member roads we are quoting below conclusions reached by the Baldwin Locomotive Works and General Steel Castings Corporation as result of this test:

"The waist sheet bearer at the guide yoke results in a high reaction downward through the sheet which gives a peak in the bending moment curve at this point. From the diagram it does not appear that this waist sheet is contributing much to the vertical resistance.

"It is possible, particularly on a locomotive bed casting, to cast a bracket of ample strength integral with the bed which would withstand the upward thrust of the crosshead so that the necessity of waist sheet at this point is questioned.

"The waist sheet in front of the rear drivers appears to offer more resistance than other waist sheets, causing deflection. This is evident, since the effect of a reaction is to level out the bending moment curve and tests indicate that this support while not unyielding, nevertheless offers resistance to vertical deflections.

"The front and rear furnace bearers react closely to the calculated values and it is evident that a broad base bearing of this type is most effective in withstanding vertical thrusts.

"The final conclusions reached are that it does not appear that eliminating all connections between frame and boiler from firebox to smoke box saddle is advisable. It is therefore suggested that a single boiler bearing located midway between cylinders and front furnace bearer, say between main and intermediate drivers, would offer maximum support to vertical deformations and minimize the stresses in the region immediately rear of the cylinders. The bearing should have sufficient rigidity to withstand vertical impact without yielding, at the same time provisions should be made for longitudinal expansion of the boiler. This could be obtained with a sliding shoe bearing which would offer a large bolting flange to cradle the boiler and provide a low unit pressure on the sliding surface, insuring positive resistance at all times."

One member road built some locomotives in 1937, others in 1939, with a single boiler support midway between cylinders and front furnace bearer, (Style 1). Another road is now rebuilding some locomotives with a single support (Style 2).

Exhaust Steam Injectors and Exhaust Steam Feedwater Heaters

The sub-committee has continued the study of exhaust steam injectors and in addition exhaust steam feedwater heaters and was instructed to submit informative report covering reliability, maintenance, service, etc., of both, the exhaust steam injectors and exhaust steam feedwater heaters.

Manufacturers of respective equipment advised the application of their product to locomotives in the United States and Canada as follows:

Exhaust steam injectors	1,200	(2 mfgrs.)
Exhaust steam feedwater heaters, closed heater, pump type	5,160	(2 mfgrs.)
Exhaust steam feedwater heaters, open heater, pump type, including turbo injectors	3,893	(3 mfgrs.)
Total	10,253	

In response to a questionnaire sent out by the secretary, so-

liciting information to develop comparative reliability, maintenance and service data from roads using above injectors or heaters, replies were received from 36 railroads on injectors and from 53 railroads on heaters. Most railroads reported in detai as requested, only a few stating that no information was available.

All types of devices as reported employ exhaust steam for raising temperatures of the boiler feedwater. In the open-type heater, the condensed exhaust steam forms a part of the boiler feed, same as the exhaust steam injector, whereas in the closed type heater, the exhaust steam does not contact the feedwater.

[The report includes statements covering results of data requested, the number of failures, delays, as well as maintenance costs, etc., being based on performance of years 1937, 1938 and 1939, as this three year period indicates the general prevailing condition.—EDITOR.]

The boiler pressure of locomotives equipped with exhaust steam injectors varied from 170 to 300 lb. per sq. in. and of locomotives equipped with exhaust steam feedwater heaters from 175 to 310 lb. per. sq. in.

As to inquiry of questionnaire reading "Has the use of exhaust steam injectors or heaters had any effect on boiler maintenance," most replies indicate that devices reported have generally not been in service a sufficient length of time to notice a definite effect while a few claim small savings on boiler maintenance with extent unknown. Also as to the inquiry, "In bad water districts is the fuel and water saving reduced because of scaling condition," replies indicate that open heaters are not affected while closed heaters are affected with extent depending on condition.

The sub-committee desires to continue its studies on the economies of the various types injectors and heaters as now used in order to develop more accurate maintenance and repair costs, differentiating between running and classified repairs, both labor and material.

The secretary will be requested to issue a questionnaire to members covering a record of such expenditures for period July 1, to December 31, 1940.

Development and Use of Oil-Electric Locomotives

The committee on the Development and Use of Oil-Electric Locomotives has continued to assemble information as to the use of this type of equipment, has brought up to date all information previously assembled by adding thereto units placed in service during the year 1939, and has also included in the report a statement showing those units on order as of January 1, 1940.

On December 31, 1939 there were 749 Diesel units in operation. 250, or approximately 33 per cent of the total were placed in service during the year 1939 by 52 railroads and operating companies. The installations during that year exceeded the installations of any previous year by 61 per cent.

Our study also developed that up to and including the 1939 report there were 122 railroads and operating companies operating Diesel locomotives as compared with 99 as of December 31, 1938, an increase of 23, and as a further indication of the extended use of this equipment during the year 1940, the committee found that on January 1, 1940 there were 57 Diesel locomotives on order for 16 railroads and operating companies.

The previous report of the Committee indicated that there were 23 units of 2,000 hp. or larger operated in combination on various railroads, making a total combined horsepower of from 2,000 to 6,000, which units, for the purpose of this report, have been considered as one Diesel-electric locomotive, and during the year 1939 there were 21 additional Diesel locomotives in this classification placed in service.

Continuing the previous tabulation designed to show the diversified use of the Diesel locomotive, the following table indicates the number of Diesel locomotives of varying horsepower that have been placed in service prior to December 1, 1939:

Horsepower	Delivered 1939	Delivered Prior to 1939	Per Cent Increase During 1939
Less than 300	2	23	8.6
300 to 600	13	118	11.0
600 to 900	132	235	56.1
900	7	73	9.5
950 to 6,000	96	50	190.0

It is particularly noted that of a total of 250 units placed in service during the year 1939, 107 were of 600 hp. and 73 were of 1,000 hp. In previous years the 600 hp. seemed to have enjoyed the most general adoption, but during 1939 there was a decided trend toward 1,000 hp. units; 73 being placed in service, whereas prior to 1939 only 4 of this horsepower were in use.

[The report includes two tables showing the Diesel locomotives in service, classified by year and horsepower over a 15-year period, and by class of service.—EDITOR.]

During the year the railroads were canvassed in an effort to assemble information as to availability, lubrication and fuel oil consumption, cost of repairs and with special request to distribute the cost of repairs between electrical and Diesel equipment. From the reports of ten selected railroads the results of this six months operation on seventy-one 600 hp. Diesel-electrics and twenty-seven 900 hp. Diesel-electrics are tabulated on Table II. This table is of interest since it shows the variation in cost between various railroads and the average combined total for the railroads in each group.

The locomotives considered are of various ages and there is a considerable number of recent construction included, which, in part, accounts for the variation in maintenance costs, but the information reference availability, lubricating and fuel oil performance shows less variation and indicates what the railroads are finding in actual operation.

A question has been raised with reference to the relation of the cost of maintaining the electrical and Diesel equipment. For the 600 hp. units it was developed that the cost of maintaining the electrical equipment is approximately 18 per cent of the total and this expense is divided about 82 per cent labor and 18 per cent material. The cost of maintaining the Diesel equipment is approximately 59 per cent of the total and this expense is divided about 65 per cent labor and 35 per cent material. With

Table II—Record of Diesel-Electric Locomotive Operation and Maintenance Cost of Selected Railroads for a Six Months' Test Period

Railroad index	No. of units	Hours assigned	Hours operated	Per cent of assignment operated	Gallons lub. oil		Gallons fuel oil		Cost of Repairs					Per loco. hour
									Electrical equipment		Diesel equipment			
					Total	Per hour	Total	Per hour	Labor	Material	Labor	Material	Total	
600 hp.														
1	4	16,748	16,748	100.00	1,307	.0780	98,602	5.887	$772.70	$204.18	$2,382.40	$834.08	$4,193.26	.2504
2	6	24,736	24,347	98.43	4,483	.1841	133,567	5.486	508.94	18.01	2,732.25	1,931.80	5,369.12	.2205
3	29	121,975	115,504	94.69	15,181	.1314	589,177	5.101	2,853.10	907.07	8,295.00	4,387.84	19,705.12	.1706
4	5	20,527	19,029	92.70	2,622	.1378	91,120	4.788	1,193.02	451.04	1,588.16	1,569.36	7,195.72	.3781
5	14	61,152	39,989	65.39	7,122	.1781	322,620	8.068	4,301.06	413.91	9,772.10	5,083.78	28,940.08	.7237
6	6	26,208	22,073	84.22	2,138	.0969	126,045	5.710	*	*	*	*	6,663.07	.3019
7	3	12,545	11,814	94.17	1,502	.1271	62,040	5.251	*	*	*	*	4,648.00	.3934
8	4	15,472	13,364	86.38	1,202	.0899	56,738	4.246	*	*	*	*	3,139.51	.2349
TOTAL	71	299,363	262,868	87.81	35,557	.1353	1,479,909	5.630	$9,628.82	$1,994.21	$24,769.91	$13,806.86	$79,853.88	.3038
Average	..	4,216	3,702	87.81	501	.1353	20,844	5.630	.....	.....	.....	.....	1,124.70	.3038
900 hp.														
2	3	8,332	7,903	94.85	1,680	.2126	62,283	7.881	$151.03	$234.85	$1,153.44	$1,025.99	$2,578.29	.3262
3	8	34,101	31,942	93.67	4,255	.1332	188,002	5.917	1,524.86	312.21	2,738.80	481.75	6,229.18	.1950
4	3	12,529	11,869	94.73	1,664	.1402	81,159	6.838	913.21	117.87	2,407.21	2,101.98	6,373.15	.5370
9	2	8,056	7,745	96.14	2,172	.2804	53,778	6.944	150.34	13.59	637.93	1,505.69	3,076.93	.3973
10	2	8,736	8,254	94.47	2,279	.2761	63,918	7.744	*	*	*	*	2,017.79	.2445
6	9	39,312	34,049	86.61	4,296	.1262	198,210	5.821	*	*	*	*	7,757.55	.2278
TOTAL	27	111,066	101,762	91.62	16,346	.1606	648,350	6.371	$2,739.44	$678.52	$6,937.38	$5,115.41	$28,032.89	.2755
Average	..	4,114	3,769	91,62	605	.1606	24,013	6.371	.....	.....	.....	.....	1,038.26	.2755

* Information not available.

Table III—Applications of Roller Bearings in the United States and Canada

	Timken	SKF	ASF	Hyatt	Fafnir	All
Total engine trucks equipped	556	489	87	0	0	1,132
Total main drivers equipped	387	63	0	0	0	450
Total other drivers equipped	387	51	0	0	0	438
Total all drivers equipped	387	44	0	0	0	431
Total trailer trucks equipped	309	120	100	0	0	529
Total tender trucks equipped	495	279	176	10	9	969
Total eng. trk. bearings applied	2,084	1,926	348	0	0	4,358
Total main driver bearings applied	850	146	0	0	0	996
Total other driver bearings applied	2,366	232	0	0	0	2,598
Total all driver bearings applied	3,216	378	0	0	0	3,594
Total trailer trk. bearings applied	1,118	494	390	0	0	2,002
Total tender trk. bearings applied	5,896	3,420	2,112	116	108	11,652
Per cent of total eng. trk. bearings applied	47.82	44.194	7.985	0	0	.....
Per cent of total main driver bearings applied	85.341	14.658	0	0	0	.....
Per cent of total other driver bearings applied	91.07	8.92	0	0	0	.....
Per cent of total trk. bearings applied	55.844	24.675	19.48	0	0	.....
Per cent of total tender bearings applied	50.60	29.351	18.125	0.995	0.926	.....
Per cent bearings reported of total number applied, e. t.	69.481	64.382	47.126	....	....	.....
Per cent bearings reported of total number applied drivers	48.569	95.238	....	....	....	.....
Per cent bearings reported of total number applied trl. trk.	59.391	71.659	30.769	....	....	.....
Per cent bearings reported of total number applied tender	62.754	69.59	23.295	100.00	22.222	.....

the 900 hp. units there was a slight variation in the percentages, although this is undoubtedly due to the variation in the average age of the units considered.

Attention is directed to the total hours operated for six months period by the seventy-one 600 hp. units. 3,702 hours per unit during this period is 87.81 per cent of the continuous assignment of 24 hours per day and represents 20.2 hours actually operated each calendar day, which is an indication of the availability of this equipment.

The information as to estimated cost of repairs over considerable periods of operation is quite clearly set forth in the committee's 1939 report. With the additional information contained in this report as to availability, lubricating and fuel oil performance and distribution of cost of repairs between electric and Diesel equipment, it is felt that sufficient information is available to justify consideration of suspension for the present at least of activities of this committee and it is so recommended.

Table IV—Relative Maintenance Costs of Friction vs. Roller Bearing Locomotives

Key No.	Dr.	E.T.	T.T.	Tender	Loco. maintenance costs per mile (labor and material) Per engine of classes reported: Friction	Roller	Average monthly mileage per class: Friction	Roller	Type of loco.
3	x	x	x	x	.2327	.1452	7,754	15,538	4-6-4
6	x	x	–	x	.2514	.1611	2,055	6,182	2-10-4
6	x	x	x	x	.1645	.1035	6,062	9,611	4-8-4
10	–	x	x	–	....	....	9,950	10,800	....
15	–	x	–	–	.217	.209	8,500	8,500	....
18	–	–	–	–	.186	.130	4,300	7,600	....
19	Ma.	–	–	–	....	....	4,700	6,500	4-6-2
21	x	x	x	x	.1465	.1288	7,350	8,900	4-8-4
24	x	x	–	x	....	....	7,000	7,000	....
26	x	x	x	x	....	....	6,516	7,714	....
29	–	–	–	–	.2033	....	....	....	....
29	–	–	–	–	.1448	....	....	....	....
29	–	–	–	–	.1708	....	....	....	....
30	x	x	x	–	....	....	6,000	11,000	4-6-2 / 4-6-4
33	x	x	x	x	.402	.204	4,105	6,554	2-8-8-2
38	x	x	x	x	....	....	6,093	7,791	....

Replies to questionnaire as to difference in maintenance cost (labor and material) of bearings, driving boxes, hub liners, etc., of engines equipped with roller bearings versus friction bearings, indicate that roads did not keep a record of such costs and only a few roads replied to the inquiry.

Standardization of Valves for Locomotives

Since the A. A. R. Standard valves were adopted as recommended practice, the committee has endeavored to secure information as to the service rendered by the valves and the possibility of improvement in the design or the materials of which the valves are made.

In response to a questionnaire issued for this purpose, the railroads report generally that the service obtained is superior to that obtained from other than A. A. R. valves, but that some minor difficulties have been encountered, which are being given consideration by the committee.

On valves of the outside screw and yoke type, used in locations requiring frequent operation of the valve, there have been some cases of stripping of the bonnet threads, the bonnet being made of bronze and the stem of stainless steel. To overcome this difficulty and to improve the construction of the valve, the committee has developed the design of bushing with locknut for application in the bonnet as shown on Pages F-174A, 174B and 174C, which is now submitted as recommended practice for new or repaired bronze O. S. & Y. type valves.

The material specification has been revised to include this bushing and locknut, and also to increase the Brinell hardness of the seat ring and disc on all valves from 175 to 225, which is considered more satisfactory for these parts.

The committee still has under consideration the proposed standard valves for superheated steam up to 400 lb. pressure and a temperature of 750 deg. F., but have as yet been unable to complete the assignment, pending advice from the Committee on Specifications for Materials as to the proper materials to be used for valves of this character.

Roller Bearings for Locomotive and Tenders

The sub-committee reported in 1939 in detail on general description of methods and practices in effect relative to mounting, dismounting, inspecting, replacing, reconditioning, cleaning, lubricating, etc., of roller bearings, together with statement giving location of roller bearings on which the member roads have been reporting December 1, 1935, to June 1, 1938.

The statement in Table III has been revised including all applications up to December 1, 1939.

The sub-committee was instructed to obtain further experience of roads with regard to roller bearings and their effects upon other parts of locomotives, also develop further information as to economies of such bearing as compared with friction bearings.

Questionnaires were issued by the secretary requesting detailed information and experience of driving box, engine truck, trailer truck, tender truck, side and main rod, valve gear and miscellaneous application of roller bearings as of December 1, 1939.

[The report includes detailed tabulations of roller bearing applications on engine, truck, driving, trailing truck and tender axles, on side and main rods, and valve gears. The tabulations show the number of applications, total mileages made, nature and number of bearing failures and the mileages made per bearing failure.—EDITOR]

Relative to the guarantee of roller bearings as applied to locomotives and tenders, the sub-committee understands that the customary guarantee given by all roller bearing companies is as follows:

0-100,000 miles	Replace, no charge
101,000-150,000 miles	Replace 20 per cent of sales price
151,000-200,000 miles	Replace 40 per cent of sales price
201,000-250,000 miles	Replace 60 per cent of sales price
251,000-300,000 miles	Replace 80 per cent of sales price
over 300,000 miles	Replace 100 per cent of sales price

As to repairing roller bearings found defective—two plans may be followed:

a—Manufacturer to repair parts involved at nominal repair charge and returning bearings for further service with no mileage credit.

b—Manufacturer to repair bearing—no charge. Bearing returned to service with a credit for mileage made to date of removal.

In either case manufacturer to decide whether to repair or to replace bearing.

All failures of roller bearings due to wrecks, or which can be shown to have been caused by neglect on the part of railroad should not be considered part of manufacturers' responsibility.

Relative to inquiry as to hot boxes experienced with roller bearings, only three roads reported hot boxes—three boxes on tenders, and three boxes on locomotives, no data being given as to reason why hot boxes occurred.

As to cost of lubrication per 1,000 miles of roller bearing equipped axles as compared with friction bearings of the same class of locomotives, nearly all roads reported "No record." The cost figures reported by a few roads, we believe, do not indicate a reliable average figure.

One road referred to above is now applying axles made of normalized and tempered manganese vanadium steel of the following chemical properties in per cent:

Carbon	0.27-0.34
Manganese	1.45-1.75
Silicon	Min. 0.15
Phosphorus	Not over 0.045
Sulphur	Not over 0.050
Vanadium	Min. 0.15

(Yield point—70,000 lb. per sq. in.)

The same road is obtaining axles in accordance with A. A. R. Specification M-104-37, Class A, normalized and tempered with roller bearing surfaces cold rolled, one axle being provided with a stress relief groove for test.

One road, reporting no axle failures, uses a low-carbon-nickel steel of the following chemical properties (in per cent) for driving and trailer axles:

Carbon	0.25-0.32
Manganese	0.75-0.95
Phosphorus	0.045
Sulphur	Max. 0.05
Silicon	0.15-0.35
Chromium (max.)	0.15
Nickel	2.50-3.00

One road, reporting no axle failures, uses a carbon vanadium steel.

Shelling of Trailer Wheel Tires

The shelling of trailer tires is now being studied on the six railroads having the greatest amount of trouble.

During the past two years, on these six roads, there has been an increase in the application of heat-treated tires, and the data collected for the period ending October 1, 1939, indicates results have been more satisfactory with heat-treated tires than with non-heat-treated tires.

The sub-committee feels it advisable to continue this study for an additional period, in order to derive the benefit of tests now being made on the above mentioned roads with heat treated tires.

[The report included a tabulation of tire failures reported for a six-month's period ended October 1, 1939.—Editor]

Fusion Welded Locomotive Boiler

At the Mechanical Division conventions held in June, 1937, 1938, and 1939, the Committee on Locomotive Construction submitted report on the above subject. Since these reports were submitted we now have advice that the second semi-annual inspection in the second year of service was made on November 17, 1939, at Oneonta, New York, of the boiler of D. & H. locomotive No. 1219. At this time the boiler was washed, inspected and hydrostatic test applied. Jacket and lagging was removed to inspect the welded seams. Hydrostatic test was of 350 pounds pressure and the inspection showed that the welding of the wrapper sheets and the welding of the firebox, after being carefully examined, were found to be in good condition. The locomotive had made 134,000 miles up until that time and to that date there had not been a simmer from any of the welds.

We have a further letter from the superintendent of motive power dated April 5, 1940, in which he states that since his letter of November 22, 1939, no trouble has been experienced from this boiler and that it has not given any trouble since it was first applied to the locomotive and placed in service on September 24, 1937.

The Committee will continue to follow this matter during the period of inspection required by the Federal inspectors who specify that in the first year of service the lagging and jacket is to be removed and the joints examined each three months, in the second year each six months, and yearly thereafter for a period of five years.

Research Program Covering Axles, Crank Pins and Bearings

[The sub-committee's report was in the nature of a summary of a complete report to be sent to the members at a later date. —Editor]

Introduction

The first progress report issued in May, 1938, stated that the Committee proposed to make further study which would be confined to main crank pins only of both failed pins and pins which were found defective upon inspection. This present report is based on the analysis of information submitted in reply to a questionnaire sent to locomotive voting members, asking them to keep a record of main crank pin renewals and failures for the period November 15, 1937, to August 15, 1938.

A total of seventy-eight railroads sent information in reply to the questionnaire, reporting the ownership of 43,468 steam locomotives. A total of 1,695 main crank pins were removed from these locomotives during the above period. Switching locomotives and three-cylinder locomotives are not considered, as it was felt they were not representative of conditions under investigation. Locomotives reported as being in combination freight and passenger service are included in passenger service tabulations. Main crank pins that were stated as being bored for internal lubrication have been classed as hollow pins. Composite pins have been classed as solid pins.

Analysis of Crank Pin Failures

Total number of main crank pin failures—The total number of main crank pin failures on steam locomotives used in freight and passenger service is:

	No. of Failures
Locomotives in freight service	83
Locomotives in passenger service	68
Total for 9 month's period	151

Average mileage before failures of crank pins—The average for each class of service is:

	Mileage
Locomotives in freight service	165,500
Locomotives in passenger service	169,600
Average mileage for all failures	167,000

Location of failure on crank pins—An analysis of the location of failures on main crank pins shows that in both freight and passenger service more failures occurred in the wheel fit than at any other location on the crank pin. The distribution for each class of service is:

	Percentage
Locomotives in freight service	
In wheel fit	41.34
Flush with hub face	32.0
At fillet next to hub	18.66
At side rod journal	4.0
At fillet between main and side rod; main rod journal; and eccentric fit	4.0
Total number of failures of known location on freight locomotives	100.0
Locomotives in passenger service	
In wheel fit	54.10
Flush with hub face	18.03
At fillet next to hub	18.03
At side rod journal	6.56
At eccentric fit	3.28
Total number of failures of known location on passenger locomotives	100.0

Location of crank pin failures on sides of locomotives—More crank pin failures occurred on the left than on the right side of locomotives, although in the case of passenger locomotives for the period covered by questionnaire failures of main crank pins were evenly divided between the right and left side of the locomotives. Ratio of number of failures on left side and number on right side is:

Freight locomotives	1.31
Passenger locomotives	1.00
Total combined freight and passenger	1.16

Causes of crank pin failures—As in a previous report, the number of failures for which the railroads reported "unknown causes" or "progressive fracture" without giving a cause for these progressive fractures have been grouped together. The main causes for the failures in the different locations are as follows:

a. The cause of 68.75 per cent of the failures in the wheel fit are reported as unknown.

b. The cause of 65.71 per cent of the failures flush with hub face are reported as unknown.

c. The cause of 36.0 per cent of the failures at the fillet next to the hub were reported as unknown.

d. The cause of 85.72 per cent of the failures in side rod journal were reported as unknown.

e. Poor machining was reported as the cause of 60.0 per cent of the failures at fillet between main and side rod, main rod journal and eccentric fit.

Types of locomotives on which failures occurred—Main crank pin failures are classified by types and the analysis indicates that:

1—In freight service in proportion to the number of locomotives in service, more failures of main crank pins occurred on the 4-8-4 type, although the greatest number of actual crank pin failures occurred on the 2-8-2 type.

2—In passenger service the situation is somewhat confused, owing to the number of locomotives that are commonly classified as a freight type locomotive being included in the passenger classification owing to the fact, as stated in the introduction, that where locomotives were reported as being in both freight and passenger service they were classed as passenger. In proportion to the number of locomotives in service the highest ratio of failures on the types that might be classed as commonly used in passenger service occurred on the 4-8-4 type locomotives, while the greatest actual number of failures occurred on the 4-6-2 type locomotives.

Stresses in failed crank pins—Fibre stresses for different crank pin materials and different locations classed by locomotive types and by service are given in four tables. The stresses were computed according to A. A. R. recommended practice. The maximum fibre stress recommended by the A. A. R. is 16,000 lb. per sq. in., and the tables show that the stress in 42.4 per cent of the total number of crank pin failures was above this limit. The stress in 27.2 per cent of the total number of main crank pins that failed was found to be in the range between 15,000 and 16,000 lb. per sq. in.

Analysis of Crank Pin Removals

Average mileage before renewal of main crank pins—The average mileage before renewal of main crank pins for causes other than failure is as follows:

Class of Service	Average Mileage When Removed: Found Cracked On Inspection	Reached Wear Limit	Reached Mileage Limit
Freight	104,500	144,300	164,000
Passenger	116,900	174,000	164,000

These results seem inconsistent in the case of freight locomotives with respect to the mileage attained on pins removed on account of reaching the wear limit and mileage limit. This inconsistency is due to the fact that service conditions undoubtedly influenced the results more in the case of freight locomotives. For example, on the 4-8-4 type locomotives 25 pins were shown to have been removed on account of reaching the wear limit with an average mileage of 127,900 miles, while 22 pins were shown to have been removed on account of reaching the mileage limit with an average mileage of 250,400 miles.

Total number of crank pin renewals—The total number of main crank pin renewals for causes other than failures on steam locomotives used in freight service is as follows:

	No. of main crank pins renewed
Locomotives in freight service	827
Locomotives in passenger service	744
Total for 9 months' period	1571

Cause of crank pin renewals—A summary of the causes of main crank pin renewals, for causes other than failures, on steam locomotives used in freight and passenger service is as follows:

Class of Service	Found cracked on inspection	Per cent of total	Reached wear limit	Per cent of total	Reached mileage limit	Per cent of total	Total
Freight	34	4.1	605	73.2	188	22.7	827
Passenger	137	18.4	347	46.7	260	34.9	744
Total	171	10.9	952	60.5	448	28.6	1571

Types of locomotives on which pins were renewed on account of being cracked—The analysis of main crank pins found cracked on inspection indicates that:

1—In freight service in proportion to the number of locomotives in service, more cracked pins occurred on the 4-8-4 type, although the greatest number of cracked pins were found on the 2-10-2 type.

2—In passenger service in proportion to the number of locomotives in service, more cracked pins occurred on the 4-6-4 type, although the greatest number of cracked pins were found on the 4-6-2 type.

Stresses in crank pins removed for causes other than failure—Fibre stresses for different crank pin materials and different types of locomotives used in freight and passenger service are given in two tables. The stresses were computed according to A. A. R. recommended practice. The maximum fibre stress recommended by the A. A. R. is 16,000 lb. per sq. in., and the above tables show that the stress in 43.1 per cent of the total number of main crank pins removed was above this limit. The stress in 19.7 per cent of the total number of main crank pins removed was in the range between 15,000 and 16,000 lb. per sq. in.

Combined Analysis of Main Crank Pins That Failed in Service or Were Removed for Other Causes

Average mileage—The average mileage of all pins removed is shown in a table which indicates that the general average for main crank pins in freight service is 148,600 miles, and in passenger service 161,100 miles. This is less than the average of failed crank pins due to the low average mileage of 104,500 in freight service and 116,900 in passenger service of main crank pins found cracked on inspection.

Total number of main crank pin renewals—The summary of main crank pin renewals is as follows:

	No. of main pins renewed
Locomotives used in freight service	896
Locomotives used in passenger service	799
Total for 9 months' period	1695

Cause of main crank pin renewals—A summary of the cause of renewal of all main crank pins in both freight and passenger service is as follows:

Class of Service	Failed	Per cent of total	Found cracked on inspection	Per cent of total	Reached wear limit	Per cent of total	Reached mileage limit	Per cent of total	Total
Freight	69	7.7	34	3.8	605	67.6	188	20.9	896
Passenger	55	6.9	137	17.2	347	43.4	260	32.5	799
Total	124	7.3	171	10.1	952	56.2	448	26.4	1695

Crank pin materials—The material and average mileage obtained at renewal for different materials where same could be definitely determined, classified by cause for renewals is shown in two tables. This is shown as a matter of information, as it is felt the data is insufficient to permit of drawing any conclusions.

Types of locomotives on which main crank pins were renewed

on account of having failed or being found cracked—This information is shown classified by types of freight locomotives in two tables which indicate the number of locomotives of various types in service as of September 1, 1938, and that:

1. In freight service, in proportion to the number of locomotives in service, more renewals on account of failed or cracked pins occurred on the 4-8-4 type, although the greatest number of renewals occurred on the 2-8-2 type, closely followed by the 2-10-2 type.

2. In passenger service, in proportion to the number of locomotives in service, more renewals on account of failed or cracked pins occurred on the 4-6-4 type, although the greatest number of renewals occurred on the 4-6-2 type.

General Conclusions

All indications point unmistakably to the fact that main crank pin failures are relatively more frequent, both in freight and passenger service, on modern engines capable of exerting high horsepower at high sustained speeds. This can readily be seen from a study of the data which indicates that for any driving wheel arrangement, as the number of trailing wheels increase, necessitated by the increased firebox and boiler capacity, the ratio of failed and cracked pins to the number of locomotives in service increases. Inasmuch as the data also points to the desirability of holding the fibre stress below 15,000 lb. per sq. in., the logical conclusion is that to reduce the possibility of main crank pin failures in locomotives designed for high horsepower outputs at sustained high speed, the total piston thrust should be divided over two driving units.

This, however, does not help the situation with respect to the many locomotives now in service, and which will be continued in service for some time to come. The situation is not critical as evidenced by the fact that on a yearly basis the number of main crank pins that fail in service is only two tenths of one per cent of the number of main crank pins in service, and the yearly cost of replacing main crank pins that fail in service or are found cracked on inspection amounts to approximately $30,000. However, the failure of a main crank pin on a locomotive at high speed will cause damage out of all proportion to the actual cost of replacing a crank pin, so that anything that can be done to prevent such failures is well worthwhile.

Proper machining is one remedy that is directly in the control of the individual road. Poor machining is indicated as the cause of 23.54 per cent of all main crank pin failures, so that considerable improvement can be attained through careful attention to proper machining. The importance of proper machining increases as the severity of service conditions increases so that on the modern types of power used under severe service conditions proper machining is paramount.

Next to proper machining probably the most feasible action that can be taken is to set up proper mileage limitations, depending on the type of locomotive and conditions of service. This cannot be set up on an average basis for all railroads, but must be done by each road for itself, adjusting the limitations set up in accordance with the ratio of the actual service conditions under which the locomotives are being used as compared to the general average. It is felt that the information contained in the analysis in this report will be helpful to roads desiring to set up such limitations.

As indicated before, it seems apparent that to materially increase the average life of main crank pins before failure it is necessary to considerably reduce the stress or find some means of improving the life expectancy under the present stresses. On existing engines, it is out of the question to reduce the stress, and on many new locomotives it will be found impossible due to limitations imposed in design on account of the axle diameter and stroke to secure a main crank pin with a fibre stress below 15,000 lb. per sq. in. Therefore, if means can be found to increase the life expectancy of the pin under the higher stresses it is important. From other investigations that have been conducted in somewhat analogous problems the committee is aware of two procedures that offer possibilities. These are: (a) Cold rolling the wheel fit of the crank pin; (b) Flame hardening the wheel fit of the crank pin.

These are definitely experimental, but the committee feels that with the issuance of this report all has been accomplished that can be accomplished by statistical studies, and these studies point to the need of some means of increasing the life expectancy of main crank pins. It is believed that this is a proper subject for A. A. R. experimental work, and it is recommended that consideration be given to granting an allowance for such work along these lines next year.

Tolerance for Cotter Keys

Conditions as regards variation in diameter of cotter keys as made by manufacturers, we find are substantially as reported by a member road. Further, we find that the various locomotive builders and railroads have no regular standards for the ordering of cotter keys but place orders as required with the different manufacturers of cotters, ordering same to the diameter of the drilled hole for the cotter.

We have canvassed the various cotter manufacturers, suggesting that an attempt be made to maintain a tolerance of nominal diameter —.005 inch, with the following results.

(1) To produce cotters to closer tolerances than present commercial standards does not appear attractive to the cotter manufacturers and they showed only meager evidence of a desire to cooperate in this direction.

(2) They pointed out that the cotters being made from wire are subject to two tolerances—one, the tolerance allowed on the wire size itself and the other, the tolerance allowed in the formation of the cotter.

(3) If a tolerance of nominal diameter —.005 inch is our aim, they would insist on a range from —.005 inch to —.010 inch under the nominal diameter.

(4) These would be special for railroad work and would not be carried in stock, necessitating the manufacture in relatively small quantities of cotters in the various sizes.

(5) Existing sizes conform to Government standards, Navy Department standards, Automobile manufacturers, and many others.

(6) When made to a tolerance of —.005 inch to —.010 inch under nominal size, the cost would be approximately 50 per cent more than the sizes now furnished in quantities of 100,000 and with smaller quantities the cost would be still further increased.

Conclusions—Inasmuch as cotters as now furnished are satisfactory for all other kinds of machinery and for many locations in locomotive construction, it would be the recommendation of this Committee that no change be made in existing standards, but where a tighter fitting cotter is desired, some form of expanding cotter be used.

The report included a statement covering tolerances secured from five different cotter manufacturers and reported by one railroad; also a summary of these various tolerances.

Locomotive Boiler and Firebox Materials and Construction

While there are numerous types of boilers and fireboxes in use, some of which are of special construction, the great majority of locomotive boilers in use on the various American railroads are of the conventional type. Therefore the committee will undertake first to determine the best solution to some of the problems encountered in the design and maintenance of large locomotive boilers of the conventional fire tube wide firebox type.

During the past decade the principal trend has been to increase capacity, efficiency and reliability of locomotive boilers and at the same time reduce the cost of maintenance.

Capacity, other things being equal, is controlled or limited by boiler diameter. Therefore it appears this is a logical basis for comparison and proportion.

Boiler diameter controls capacity, primarily due to its control of the gas area of the flues which is confined within close limits if other desirable proportions are not encroached upon, such as: Distance between crown sheet and roof sheet which controls steam disengaging surface and steam space; Distance between combustion chamber and shell at bottom and sides; minimum allowable space between flues and firebox side and crown sheets to provide for suitable flange radius to provide flexibility and prevent excessive maintenance due to sheets cracking; width of water space at mud ring on sides and rate of increase in water space from mud ring to crown sheet radius; and, distance or space between flues to provide adequate circulation for maximum efficiency and prevent cracking of tube sheets between tubes.

Other proportions which control efficiency of operation and cost of repairs are ratio of length of combustion space to flue length and ratio of flue length to flue diameter.

The firebox capacity is controlled by clearance and weight limitations only. The size of grate area should be in proportion to the maximum output expected of the boiler and the quality of the coal to be burned.

The question of the percentage of air openings through the grates and the manner of admission of air, in addition to influencing capacity and economy, may be such as to have detrimental effects on firebox sheets and staybolts.

The committee will proceed first with the further study of general structural conditions in locomotive fireboxes. A questionnaire has been prepared and has been sent out to various railroads and locomotive builders in order to obtain the latest practice, data and formulae for the benefit of the Committee in its study.

The following is a resume of an investigation made by the Denver & Rio Grande Western as to locomotive boiler back end movement under hydrostatic pressures. The Report was dated April, 1940:

"An investigation was made to determine the movement of the component parts of the back end of a locomotive boiler (4-6-6-4 type) under hydrostatic pressures. The locomotive in question having inside dimensions of firebox as follows: Length 182 inches, width 104¼ inches. The length of firebox measured from back flue sheet to firebox door sheet is 28 feet 2 inches. Two syphons are installed in the firebox and one in the combustion chamber.

"Measurements of the movements were taken at 206 points on the back end of boiler, including inside of firebox and combustion chamber. Seven tests were made under the following conditions:

Boiler empty,
Boiler filled with water, no pressure.
Boiler under 100 lb. hydrostatic pressure.
Boiler under 200 lb. hydrostatic pressure.
Boiler under 255 lb. hydrostatic pressure.
Boiler under 319 lb. hydrostatic pressure.

The above tests had a water temperature of about 100 deg. F., and the seventh test was taken with 255 lb. hydrostatic pressure with a water temperature of 210 deg. F. The outside temperature under all tests was approximately 68 deg. F. A total of 1,418 readings were taken.

In general it was found that the top sags down and the sides spread out.

The maximum downward movement was 7/16 inch for the roof sheet and 31/64 inch (or nearly ½ inch) for the crown sheet. The maximum spread (both sides together) was 43/64 inch (or nearly 11/16 inch) for the roof sheet and 35/64 inch (or nearly 9/16 inch) for the crown sheet. Maximum downward movement is ¼ inch for the syphons. Maximum spread of the mud ring was 3/32 inch. Maximum spread between the syphons was 11/16 inch. Maximum longitudinal movement was 19/64 inch (or nearly 5/16 inch) at 210 deg. temperature.

It developed that the downward movement in the vertical direction is smaller at 210 deg. F. temperature than at 100 deg. F., and the lateral spread is greater at 210 deg. F. than at 100 deg. F. temperature.

These movements indicate that the back end of a boiler is continually moving up and down in the vertical direction and in and out in the lateral direction whenever there are changes in pressures and temperatures. Therefore, the back end of a boiler must be of substantial construction in order to keep movement down to a practicable minimum. Roof sheet thickness should be developed to meet deflection requirements as well as strength requirements.

Other Items

Progress was reported by sub-committees on locomotive guiding, spring suspension and rail stresses; stresses in rods and motion work, and standardization of wrought steel wheels for Diesel locomotives and steam locomotive tenders.

The report was signed by H. H. Lanning (chairman), mechanical engineer, A. T. & S. F.; H. P. Allstrand (vice-chairman), assistant to chief executive officer, C. & N. W.; E. L. Bachman, general superintendent motive power, Pennsylvania; F. E. Russell, mechanical engineer, Southern Pacific; W. F. Connal, chief mechanical engineer, C. N. R.; J. E. Ennis, engineering assistant, N. Y. C.; J. B. Blackburn, mechanical engineer, C. & O.; L. H. Kueck, chief mechanical engineer, Mo. Pac.; W. H. Sagstetter, chief mechanical officer, D. & R. G. W., and K. Cartwright, mechanical engineer, N. Y. N. H. & H.

Discussion

D. Sheehan, superintendent motive power, C. & E. I., in commenting on the report of the sub-committee on wheel centers within thin walls sections said that he had found nine roads reporting in 1939 which are not mentioned in the 1940 report. This, he said, tended to reduce the value of the report through lack of cooperation of these roads with the committee. While the proportion of defects which have developed is not large, he said, the trend seems to be toward more failures and the character of the failures indicated the need for continuing the study.

H. W. Faus, engineer motive power, was inclined to question the conclusions of the subcommittee reporting on the Research Program Covering Axles, Crank Pins and Bearings, since the causes of failures were unknown in more than 64 per cent of the cases reported. He cited the experience of the New York Central in support of the statement that poor machine work was not an important factor in failures of these parts on that road during the past thirteen years. He referred to 32 failures of crank pins in the eccentric-crank keyways during 1928, 1929 on Classes J1a, b and c. The valve travel was reduced to 8½ in. and another keyway added. For the next two years there were no further failures. Crank-pin failures in the wheel-seat fillet were ended by a change from carbon steel to carbon-vanadium steel. Two older lots of locomotives of another class on which there were no crank-pin failures were followed by 104 failures in two years on two later lots of the same class. These crank pins were of carbon-vanadium steel with ¼-in. wheel-seat fillets. Investigation disclosed a change in heat treatment involving a lower normalizing and higher drawing temperature than previously employed. All but one of the failures were traced to this cause. At a later date failures in the eccentric-crank keyways again appeared. In this instance a change in the bolting to hold the eccentric crank more rigidly on the pin ended the difficulty. Another mild epidemic of failures through the wheel seat was also traced to the heat treatment.

While not considering poor machine work a factor in the failures experienced by the New York Central, Mr. Faus agreed with the committee that it could not be tolerated. He did not feel that the experience on the New York Central would justify the establishment of a definite mileage life for crank-pin service.

In commenting on the recommendation of the committee's suggestion of the desirability of holding the fibre stress in crank pins below 15,000 lb. per sq. in., Mr. Faus said that the design stresses in the crank pins of three classes of New York Central locomotives were as follows: J1, 18,350 lb.; J3, 19,030 lb.; L2, 19,200 lb.

The report was accepted and referred to letter ballot.

Report on Car Construction

In the report for last year we stated that the full Car Construction Committee, in cooperation with the Freight-Car Design Committee of the American Railway Car Institute, had undertaken an economic study of lightweight box-car designs in line with program of 1932, items (a) to (f) inclusive, Appendix A to Circular No. D. V.—768 for that year. Further, that tentative designs for the following types of construction had been submitted for study and analysis: Lightened design in carbon-steel riveted construction; combination of carbon-steel riveted and welded construction; alloy steel with combination of welding and riveting; alloy steel, largely of welded construction.

This part of the work has been completed and last December your committee submitted to the A. R. C. I. a detailed comparative tabulation of design characteristics, weights and other data for the above types of construction and the A. A. R. standard steel-sheathed large size box car of 1937 of carbon-steel riveted design. This tabulation of characteristics was based largely on the designs tentatively proposed by the A. R. C. I. who were advised that your committee would be glad to have this undertaking progressed on the following basis:

(1) Prepare a design (or designs) of an improved steel-sheathed box car which the A. R. C. I. Committee would recommend for quantity construction as might be required.

(2) Strength, with corresponding anticipated service life, to be

Table I—New Cars Ordered May 1, 1939 to May 1, 1940

BOX AND AUTO BOX

Item		Number of cars
1.	A. A. R. throughout	
	(a) A. A. R. Standard; height 10 ft.; width 9 ft. 2 in.; length 40 ft. 6 in.	4,917
	(b) A. A. R. Standard; height 9 ft. 4 in.; width 8 ft. 9⅜ in.; length 40 ft. 6 in.	375
2.	A. A. R. throughout except light weight	
	(a) Height 8 ft. 6⅝ in.; width 9 ft. 2 in.; length 40 ft. 6 in.	100
	*(b) Height 10 ft.; width 9 ft. 2 in.; length 40 ft. 6 in.	5,400
3.	A. A. R. throughout except light weight and to larger clear dimensions	
	(a) Height 10 ft. 5 in.; width 9 ft. 2 in.; length 50 ft. 6 in.	300
	(b) Height 10 ft. 6 in.; width 9 ft. 2 in.; length 40 ft. 6 in.	2,000
	(c) Height 10 ft. 6 1/16 in.; width 9 ft. 4¼ in.; length 50 ft. 7 15/16 in.	50
4.	A. A. R. but to larger clear dimensions	
	(a) Height 10 ft.; width 9 ft. 1½ in.; length 50 ft. 6 in.	350
	(b) Height 10 ft. 1 13/32 in.; width 9 ft. 2 in.; length 50 ft.	100
	(c) Height 10 ft. 4⅞ in.; width 9 ft. 2 in.; length 40 ft. 6 in.	1,000
	(d) Height 10 ft. 6 in.; width 9 ft. 2 in.; length 50 ft. 6 in.	1,700
	(e) Height 10 ft. 5 9/16 in.; width 9 ft. 2 in.; length 40 ft. 4 9/16 in.	100
	(f) Height 10 ft. 1⅞ in.; width 9 ft. 2 in.; length 40 ft. 6 in.	2,765
5.	A. A. R. design throughout except floating center sills	
	(a) Height 9 ft. 4 in.; width 8 ft. 9⅜ in.; length 40 ft. 6 in.	500
	(b) Height 10 ft.; width 9 ft. 2 in.; length 40 ft. 6 in.	600
6.	A. A. R. design throughout except floating center sills and to larger clear dimensions	
	(a) Height 10 ft. 4 in.; width 9 ft. 2 in.; length 40 ft. 6 in.	1,800
	(b) Height 10 ft. 4 in.; width 9 ft. 2 in.; length 50 ft. 6 in.	200
7.	A. A. R. design throughout except center plate height 26¾ in., and to larger clear dimensions (A. A. R. relation between line of draft and neutral axis of center sill maintained).	
	(a) Height 10 ft. 4 in.; width 9 ft. 2 in.; length 40 ft. 6 in.	2,000
	(b) Height 10 ft. 4 in.; width 9 ft. 2 in.; length 50 ft 6 in.	500
8.	A. A. R. design throughout except light weight and floating center sills, and to larger clear dimensions	
	(a) Height 10 ft. 4⅛ in.; width 9 ft. 2 in.; length 40 ft. 6 in.	400
	(b) Height 10 ft. 8⅛ in.; width 9 ft. 2 in.; length 40 ft. 6 in.	100
9.	Not A. A. R. design but 25¾ in. truck height	149
10.	Not A. A. R. design	4
	Total	25,410

* Including 500 special welded cars.

HOPPER CARS 50 TONS NOMINAL CAPACITY

11.	A. A. R. Standard throughout	5,415
12.	A. A. R. design throughout except light weight and changes in inside dimensions to meet specific conditions	1,500
13.	A. A. R. Standard except changes in inside dimensions to meet specific conditions	10,250
14.	A. A. R. design throughout except floating center sills	1,000
15.	A. A. R. design throughout except floating center sills and changes in inside dimensions to meet specific conditions	500
16.	Not A. A. R. design except center sill section and 25¾ in. truck height	1,000
17.	Not A. A. R. design except 25¾ in. truck height	1
	Total	19,666

HOPPER CARS 70 TONS NOMINAL CAPACITY

18.	A. A. R. Standard throughout	100
19.	A. A. R. design throughout except light weight	1,000
20.	A. A. R. Standard except changes in inside dimensions to meet specific conditions	160
21.	A. A. R. Standard except light weight and change in inside dimensions to meet specific conditions	100
22.	Not A. A. R. design. 26¾ in. truck height. Light weight	500
	Total	1,860

FREIGHT REFRIGERATOR CARS

23.	A. A. R. Standard	100
24.	A. A. R. Standard except inside dimensions Width 8 ft. 4⅜ in.; length 32 ft. 9⅜ in.	250
25.	A. A. R. Standard except inside dimensions Height 6 ft. 8 in.; width 8 ft. 3 in.; length 39 ft. 4 in. top bunkers	200
26.	A. A. R. Standard except floating center sills	300
27.	Not A. A. R. Standard. Super Giant Height 7 ft. 7½ in.; width 8 ft. 8 in.; length 42 ft. 6 in.; 26¾ in. truck height	20
28.	Not A. A. R. Standard. Super Giant Height 6 ft. 6 in.; width 8 ft. 8 in.; length 50 ft. 1 in. 26¾ in. truck height. Top bunkers	5
29.	Not A. A. R. Standard. Giant Height 6 ft. 9½ in.; width 8 ft. 8 in.; length 50 ft. 25¾ in. truck height. Top bunkers	10
30.	Not A. A. R. Standard. 50 ton with floating center sills Height 7 ft. 9 1/16 in.; width 9 ft. 1½ in.; length 42 ft. 1¾ in.	100
31.	Not A. A. R. Standard. 50 ton with floating center sills Height 7 ft. 6 1/16 in.; width 8 ft. 11 in.; length 42 ft. 1¾ in.; Super-insulated	50
32.	Wood sheathed Class B construction for meat service, A. A. R. Standard center sills, 25¾ in. truck height	350
33.	"RB" 40-ton cars for beer service. A. A. R. Standard center sills. 25¾ in. truck height	25
	Total	1,410

equivalent to that of the present A. A. R. standard car of enlarged dimensions as submitted in 1937, Appendix A to Circular DV-920.

(3) General dimensions to be same as for car under Item (2).

(4) The base design (or designs) to have doors and fixtures, roofs and ends of types as shown on Plate 1500, Appendix A to A. A. R. Circular DV-920, but of the latest designs. If desired, alternate design (or designs) may be submitted with these features similar in type to those illustrated on Plate 1501 of that Appendix.

(5) A more substantial floor structure than now shown by the present standard car drawings should be provided.

(6) Corner-post construction for the base design should be in accordance with an improved arrangement for which sketch was submitted.

At the time of our final meeting last March, this work had not advanced far enough for further joint conference, but it was then planned to call a special meeting of both committees previous to the annual meeting if progress made should warrant such action, in which case a supplementary statement would be prepared by the chairman for inclusion in the proceedings of the Mechanical Division for this year.

Welded Hopper Cars

When submitting to the A. R. C. I. the above proposed steel sheathed box-car development program, your committee also requested the preparation of tentative designs of welded and riveted 50 and 70 tons' nominal capacity hopper cars, which the car institute would be in position to recommend for quantity production as required, it being the belief of your committee that such construction, either in high-tensile low-alloy or plain carbon steel, should provide the benefits of longer anticipated useful service life account elimination of rivet holes and corrosion in lap joints and other connections present in cars of riveted construction; also that some weight reduction should be obtained.

It was proposed to the car institute that the designs shown in Appendix A, Circular DV-836, report of Committee on Car Construction dated June, 1935, should form the basis for this work.

For both capacities of cars, over-all width and height of sides from top of rail, as indicated on these drawings, should be followed. Rail load limit capacity should be obtained with lading at 52 lb. per cu. ft. including 10-in. average heap, same as for the carbon-steel riveted designs.

The status of this work and subsequent procedure is the same as described above for the improved designs of steel-sheathed box cars.

Table II—New House Type and Hopper Cars Ordered May 1, 1939 to May 1, 1940*

Item	Design	No. of cars	Per cent of total
34.	A. A. R. throughout or conforming thereto including light weight alloy steel to A. A. R. base dimensions, floating center sills, and inside dimensions to meet specific conditions	42,782	91.15
35.	A. A. R. except 26¾ in. center plate height	2,500	5.33
36.	Not A. A. R. except center sills and 25¾ in. truck height	1,000	2.13
37.	Not A. A. R. design except 25¾ in. truck height	150	.32
38.	Not A. A. R. design	504	1.07
	Total	46,936	100.00

* This is a condensed compilation of cars reported in Table No. 1 except the refrigerator cars referred to in items (23) to (33) inclusive.

Freight Cars Ordered May 1, 1939, to May 1, 1940

The 1936 report of your committee presented the question of whether or not the majority of member roads desired the continuation of the work on A. A. R. design cars. The matter was discussed on the floor of the convention. Since that time your committee has set forth in each annual report a statement of the freight cars ordered during the preceding year with sufficient characteristics of design to indicate the extent to which the member roads were following freight car A. A. R. standardization.

[At this point in the report, the committee inserted detailed tables showing a total of 46,936 new house-type and hopper cars ordered during the period of May 1, 1939, to May 1, 1940, of which 42,782 cars, or slightly over 91 per cent, were designed to

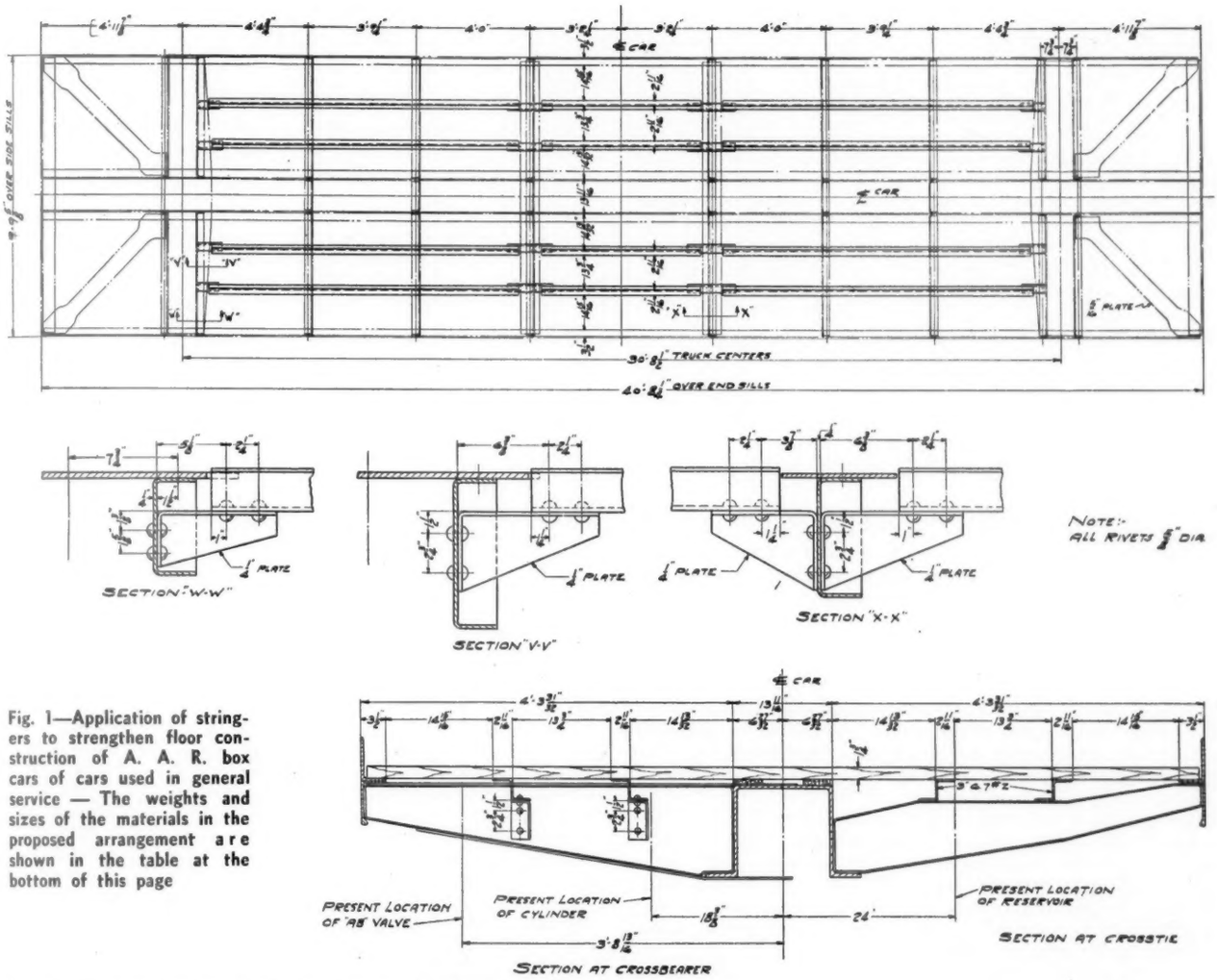


Fig. 1—Application of stringers to strengthen floor construction of A. A. R. box cars of cars used in general service — The weights and sizes of the materials in the proposed arrangement are shown in the table at the bottom of this page

"A. A. R. specifications throughout, or conforming thereto, including lightweight alloy steel to A. A. R. base dimensions, floating center sills, and inside dimensions to meet specific conditions." Of the remaining cars, 2,500 were A. A. R. design except for center-plate height; 1,150 cars conformed to A. A. R. design only in such details as center sills or center-plate height; 504 cars or 1.07 per cent were non-A. A. R. design.]

No standard A. A. R. designs of gondola, flat, stock, ballast and special type cars have been developed, and 10,036 cars of these various types were ordered in the period of May 1, 1939 to May 1, 1940. With 1,410 refrigerator cars, this makes a total of 58,382 cars, ordered in the period mentioned, of which 53,384, or 91.44 per cent have standard 25¾-in. center-plate height; 3,229 have 26 ¾-in. center-plate height; 20 have 26 ⅜-in. center-plate height; 1,700 have 26⅛-in. center-plate height; and 49 have 26-in. center-plate height.

[Table I includes the box, auto box, hopper and refrigerator cars and Table II gives a summary of the information in Table I. A third table, including gondola, flat, stock, ballast and special

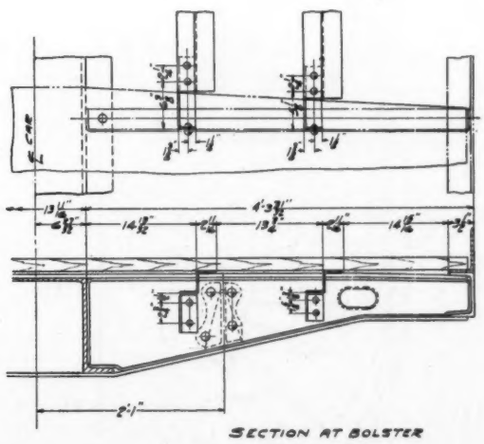


Table III—Proposed Arrangement—Weight of Floor Supports and Connections

No. per Car	Description	Material	Weight each, lb. per ft.	Total weight, lb. per ft.
4	Floor support, bolster and crossbearer	3 in. 6.7 lb. per ft. Z-bar x 10 ft.-11¾ in.	73.56	294.24
4	Floor support, bolster and crossbearer	3 in. 6.7 lb. per ft. Z-bar x 10 ft.-10¾ in.	73.0	292.0
4	Floor support between crossbearers	3 in. 6.7 lb. per ft. Z-bar x 5 ft.-7¾ in.	37.827	151.31
4	Floor support connection (section W-W)	6⅛ in. x ¼ in. x 10¾ in.	3.92	15.69
12	Floor support connection (section V-V & X-X)	7⅝ in. x ¼ in. x 12 in.	5.1	61.2
8	Floor support connection (section X-X)	7⅝ in. x ¼ in. x 9½ in.	4.0	32.0
4	Diagonal brace	10 in. x 9/16 in. x 5 ft. 9 in.	57.97	231.88
80	Rivets	⅝ in. diameter x 1⅞ in. long	....	20.8
16	Rivets	⅝ in. diameter x 2½ in. long	....	4.48
136	Floor bolt with one nut	½ in. diameter x 2¾ in. long	....	30.14
		Total weight		1133.74

type cars appeared in the report; this is not reproduced here.—EDITOR]

Box-Car Floors

The question of damage to box-car floors due to heavy concentrated loads imposed by power trucks when handling steel sheets, ingots, bars and similar lading, was referred to in the report for last year.

It has been decided in view of the information available and experience of certain roads that suitable designs of strengthened floor construction could be developed to cover the situation without conducting special loading tests and general drawings have been prepared to show the strengthened construction.

The construction for general service, as shown in Fig. 1, consists essentially of two 3-in. 6.7-lb. Z-stringers located on each side of the center sill. The diagonal braces have been increased in thickness from ¼ in. to 5/16 in.

Alternate construction where a still stronger floor construction is considered necessary or desirable by individual railroads, consists essentially of two 4-in. 8.2-lb. Z-stringers located on each side of the center sill with diagonal braces increased in thickness from ¼ in. to 5/16 in.

[A drawing, (not included in the present abstract of the subcommittee report) showed the alternate construction in detail and included a table of comparative weights and material sizes. It was recommended that these drawings and tables be submitted to letter ballot.—EDITOR]

Changes in Standard Steel-Sheathed Box Car

CORNER CONSTRUCTION

During the past year a study has been made with a view to increasing the strength of the present square corner and Z-bar corner post construction as shown on Plates 504-B and 1504, Supplement to the Manual for the A. A. R. base designs of steel-sheathed box cars.

To provide added strength against tendency of ends to bend outward with shifting loads, a number of roads already have used a rounded corner construction with a W-section corner post as shown in one of the drawings which accompanies this report. This represents a much more substantial arrangement with only a slight increase in weight as compared with the present square corner and Z-bar corner post.

It is the recommendation of your committee that the arrangement (Fig. 2) be submitted to letter ballot for adoption and if approved, the drawings in the Supplement to the Manual will be changed accordingly for base cars shown on Plates 500-B and 1500-A respectively.

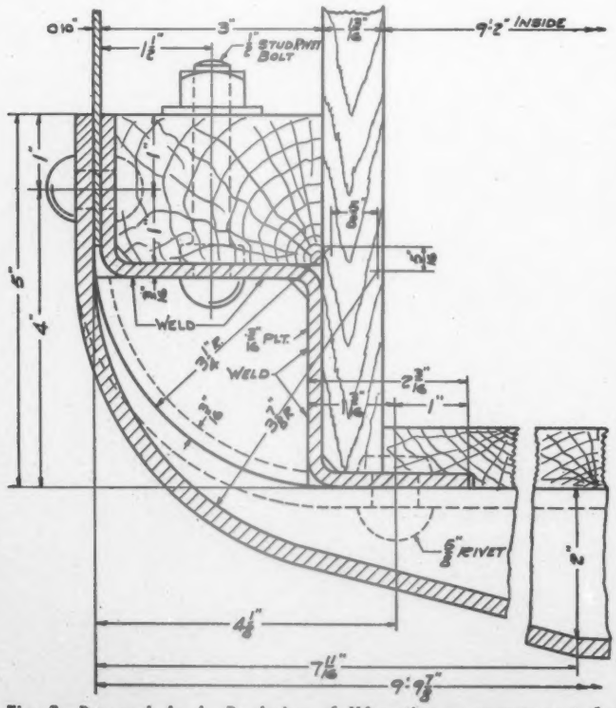


Fig. 2—Proposed A. A. R. design of W-section on corner post for 40-ft. 6-in. 50-ton steel-sheathed box cars

ROOF CONSTRUCTION

In view of the more general use of an improved solid-steel roof construction, your committee recommends incorporation in the base designs of a solid steel roof intended for future applications in place of the designs on Plates 502-B and 1502.

The following table shows a comparison of the present and proposed base designs. The comparative weight figures shown, apply only to the roof for the 9-ft. 2-in. wide car, as covered by Plate 1502:

Comparison of Present and Proposed Base Roof Designs

	Present design plate No. 1502	Proposed design
Gage of roof sheets	No. 15	No. 15
Thickness of seam caps, in.	5/32	3/16
Height of seam caps, in.	3 3/16	2¼
Complete weight per car, lb.	1,858	1,694
Saving in weight per car, lb.	....	164

Roofs of the proposed design are already in service on thousands of cars and it is believed with the better balanced low cap construction, a design will be provided which permits the entire roof to work as a unit while with the former high cap design there was a tendency for the caps to take the load before the sheet panels came into play.

The committee recommends that the roof arrangement shown as Sketch No. 4 in the report be submitted to letter ballot for adoption. If approved, the drawings in Supplement to the Manual will be changed accordingly for base cars now shown by Plates 500 and 1500.

End Lining for Box Cars

Present end lining installation for the standard box cars consists of 13/16-in. tongue and groove vertical lining boards resting directly against the corrugated-steel end and secured by nailing to horizontal wood furring strips located in corrugations and held by stud bolts. The end floor board is rabetted to receive lower ends of end lining boards and short Z-shaped metal clips are provided for holding the top of lining boards adjacent to the sides of the car.

Exceptions have been taken to this application, particularly by grain and flour shippers who have maintained that lading becomes lodged in corrugations back of end lining boards resulting in shortage, and where not removed affords breeding place for vermin. Further, that to recover lading which may become trapped in this manner usually necessitates the removal and replacement of large sections of the end lining.

Of the various alternate schemes which have been proposed from time to time, the arrangement which has been most frequently suggested by the shippers consists of applying end lining boards horizontally, secured to vertical furring strips attached to the steel end and having opening with bevel strip at bottom for self-clearing and to permit blowing out when necessary, similar to side lining application. This change in the application of end lining is not considered desirable, mainly because lining boards would be exposed to breakage by being unsupported between furring strips. Furthermore, in order to maintain present inside length of car it would be necessary to increase the overall length an amount equal to thickness of end furring strips and lining boards. To provide strength approaching that of present construction, in which lining boards are supported for the full width of the car, bearing directly against the steel end and with furring strips applied in the corrugations, it would be necessary to closely space the vertical nailing strips and materially increase the thickness of the end lining boards with resultant increase both in weight and cost of construction.

As will be noted by reference to plates 504-B and 1504 of the Supplement to the Manual, wood furring strips extending approximately the full length of the end corrugations are applied in the first three corrugations above the floor line, at center of end and in the top corrugation. If furrings are of sound wood properly attached to the steel end and lining boards are securely nailed thereto, the lining will maintain its position. Examination of a large number of cars has shown that in the majority of cases the end lining follows the steel end when the latter becomes bowed outwardly up to as much as 4 in. at center. If

the tongues and grooves of end lining boards are of correct dimensions and provide proper fit, no leakage of grain should occur, therefore, where end lining is properly applied and maintained free from holes or punctures, no difficulty should be experienced because of leakage of lading through the end lining.

Plates 504-B, 1504 show a Z-bar corner post with furring strip between the post and the steel end, this being the furring to which the side lining is nailed. There is, however, approximately 1 in. space between this furring strip and the steel-end extending from floor to roof. The corrugations in the steel end overlap this open vertical channel so that any grain leakage at the corners would be fed to the corrugations and gradually work its way over to the center of the car. Grain leakage at the corner-post opening may be caused by warpage or improper fastening of side lining to furring, short furring strips not fitted tightly against side plate or sill and poor fit between corner end lining boards and side lining. This particular condition may be corrected to a large extent by increasing the size of the corner-post furring strip to completely fill the space between Z-bar corner post and steel end, or by driving a loose wooden strip in between the furring and the steel end, making sure that this opening is blocked solid from side sill to side plate.

However, a new design of corner post construction, covered elsewhere in this report, will, if adopted, materially improve for new cars, the conditions described in the foregoing paragraphs.

Side Frames and Bolsters

During the past year, numerous new designs of side frames and bolsters were submitted for approval. Some of these new designs have been approved and in some cases the applications are still pending. Nine new side frame designs were approved, eight for 50-ton trucks and one for 70-ton trucks. Among these are various features of double-truss and spring-plankless designs. They also include Barber stabilized and full-cushion trucks. With the exception of two 50-ton and the 70-ton trucks, these were all of Grade B carbon steel; the exceptions are alloy steel.

The approved bolster designs are 15 in number, of which 8 are in alloy steel, 5 are Grade B carbon steel and 2 pressed and welded-rolled-steel designs. Applications are pending on 12 side frame designs and 7 bolster designs.

Report of Sub-Committee on Journal Boxes

To provide improved service performance and assist in preventing uneven wear in the roof of the journal box, it is recommended that the inside contour at the top of journal boxes, A, B, C, D, E, and F, be changed as shown in Fig. 3. This drawing also includes recommended increase in the depth of the wedge stop (dimension B) in order to obtain as much contact with the wedge as possible without interfering with removal of same. It will be noted that the B dimension is maximum with tolerance of 1/16 in. less, as shown in the tabulation on this sketch.

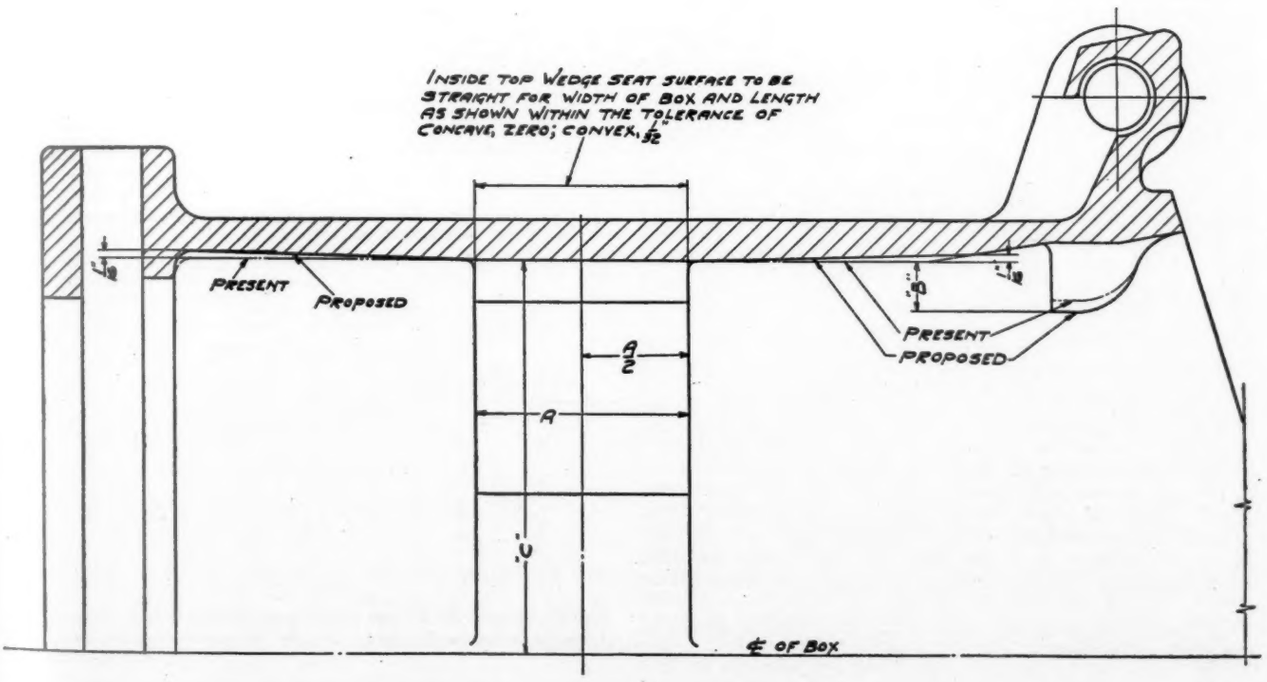
The above suggested changes have been approved by the Car Construction Committee and are concurred in by the Committee on Lubrication of Cars and Locomotives and it is recommended that the arrangement illustrated be submitted to letter ballot for adoption and if approved the drawings in the manual on Pages D-14, D-15, D-16, D-17, D-18 and D-19, will be changed accordingly.

Definitions and Designating Letters

During the past year your committee has passed upon a number of requests from car owners for designating letters for new types of freight and passenger cars. In cases where additions to or changes in the manual are decided upon, the recommendations of other interested divisions of the association were obtained before submitting such changes to the membership by letter ballot.

[The sub-committee here described the letter changes which have already been approved by letter ballot.—EDITOR.]

Your committee has also passed favorably upon new additional designations as follows: *"CSP"—Combined mail-storage or baggage, dormitory and passenger*—A car having three compartments, separated by bulkheads, one for mail storage or baggage,



Class of box	Journal size, in.	A, in.	A/2 in.	B, in.	C, in.
A	3¾ x 7	2⅜	1 3/16	7/16	3⅝
B	4¼ x 8	2⅜	1 3/16	½	4
C	5 x 9	2⅜	1 3/16	⅝	4⅛
D	5½ x 10	2⅜	1 3/16	⅝	4⅞
E	6 x 11	3½	1¾	⅝	5⅜
F	6½ x 12	3½	1¾	⅝	6
Tolerances	+	...	1/32	0	3/16
	−	...	1/32	1/16	1/16

Fig. 3—Proposed changes in the inside contour at the top of journal boxes

one fitted with sleeping accommodations for the crew and one fitted with seats for passengers.

Reason: To provide for a new type of car.

"BLF"—Flat car—A car constructed and equipped for passenger-train service, especially to carry containers for the transportation of liquids or other commodities.

Reason: To provide for a new type of car.

New Designs of Freight Cars

Since the last report, the committee has reviewed the following business in accordance with the revisions of the first paragraph of Interchange Rule 3.

Five designs, submitted by the American Car and Foundry Company, are for reinforced underframes for cars built to transport 15 1-ton chlorine containers, involving a total of 16 cars. One design was submitted by this company for welded and riveted refrigerator car. One design for a tank car, 50 cars; a modified A. A. R. underframe for tank cars, no limit, and a car structure for carrying 15 one-ton chlorine containers, five cars, were submitted by the General American Transportation Company. A new tank car underframe design was submitted by the Fleischmann Transportation Company covering 40 new underframes and 50 rebuilt underframes. A design of freight car with cradles for handling milk tanks, was submitted by Motor Terminals, Inc. A modified A. A. R. 50-ton hopper-car design was submitted by Berwind White Coal Mining Company. A special tank box car for transportation of liquid oxygen, 10 cars, was submitted by Linde Air Products Company. A light-weight box-car design, submitted by Pullman-Standard Car Manufacturing Company, was previously approved for 1,000 cars; the present approval covers the construction of 1,000 additional cars.

Passenger-Car Axles

In connection with tests of passenger car axles which are being carried on at the Timken plant at Canton, Ohio, the actual tests started on November 20, 1937, and have progressed to the extent that four progress reports have been prepared,* submitted for approval, and then sent out to the member roads. These progress reports show in detail the various designs of axles tested, based on the present A. A. R. 5½-in. by 10-in. journal, having 7-in. wheel seat diameter and black collar. From these tests a new design of axle has been established and is shown in Fig. 4. All of the axles tested were of plain carbon steel, not heat treated after forging, and in accordance with A. A. R. Specification M-101-36, Grade B. The object of these tests was to obtain an axle which would give longer service and life without failure than the present A. A. R. 5½-in. by 10-in. axle. All tests have been confined to improving the axle in the region of the wheel seat inasmuch as most service failures occur inside the wheel fit of the axle a short distance from the inside hub face. To date, these investigations have been limited to those improvements that may be obtained by modifications in design of axles.

The principal modification of design as shown on the attached drawing is increased wheel seat, maintaining the same journal dimension and approximately the same center and the same body dimensions. To check up on the new design, four axles were purchased to specification M-101-36, Grade B, and four axles to the new design to Specification M-104, normalized and tempered. These axles were tested. Axles to Specification M-104, normalized and tempered, did not show up very well and this raised the question as to the value of such treated material. This matter was discussed with the Committee on Specifications for Materials and later, by a joint committee from the specifications committee, the axle committee, and representatives from the manufacturers.

Inasmuch as the new designs have been approved by the Joint Sub-Committee on Axle Research and as this was the first part of the program, the next step was the testing of axles of the new design with a larger number of axles than the eight axles referred to above. This work is now being progressed, the axles having been ordered. As soon as they have been received they will be put in the test machines. The results of these tests will be in a later report.

While all of the work, up to this time, has been in re-designing the regular axles, we are now working on the design for drive axles. This work will be progressed as rapidly as possible and if the design for drive axles can be established it should be included in the letter ballot with the non-drive axles. If it is not completed in time for this, it will be recommended that it be covered by a special letter ballot.

In view of the fact that there are a large number of wheels now in service that in time will require new axles, probably of the new design, we are testing out assemblies with one of the existing 5½ by 10-in. journal axles with a wheel that has a three-quarter inch thick hub and have mounted this axle with pressures for cast iron wheels. These tests will be continued and report furnished later.

As in the case of the number of wheels that will be in existence for some time, consideration is also being given to what changes in machining could be done, such as removing the black collar, so that the life of existing A. A. R. 5½ by 10-in. journal axles may be increased. These tests are being conducted with miniature axles as well as with full size axles. This work will also be hurried to a conclusion.

The Joint Sub-Committee on Axle Research recommends that

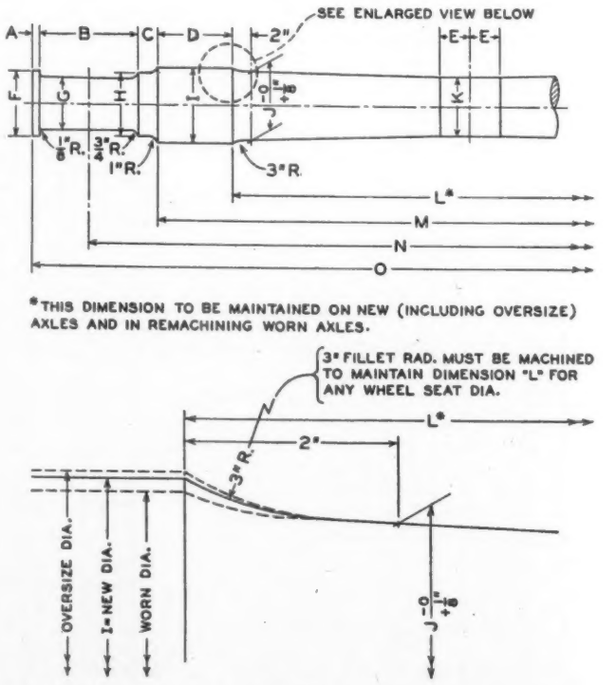


Fig. 4—New A. A. R. axle dimensions—Enlarged view showing condition at fillet joining body of axle to inside edge of wheel seat

* A summary of the fourth progress report is appended at the end of this report on Car Construction.

New A.A.R. Axle Dimensions

Classification of axle	Size of journal, inches	Dimensions, Inches A	B	C	D	E	F	G	H	I	J	K	Feet-Inches L	M	N	O
A	3¾ x 7	5/8	7	2½	7 5/8	1½	4¾	3¾	4¾	5½	4 7/8	4¼	3-11¾	5-3	6-3	6-11¼
B	4¼ x 8	5/8	8	2	7¾	1½	5¼	4¼	5¼	6 6/16	5 7/16	4¾	3-11¾	5-3	6-3	7- 0¼
C	5 x 9	¾	9	2	7 5/8	1½	6 1/8	5	6 1/8	7	6 3/16	5 3/8	3-11¾	5-3	6-4	7- 2½
D	5½ x 10	¾	10	2	7 5/8	3	6 5/8	5½	6 5/8	7 9/16	6¾	5 7/8	3-11¾	5-3	6-5	7- 4½
E	6 x 11	7/8	11	2¼	8 1/8	3	7¼	6	7¼	8 3/16	7¼	6 7/16	3-10¼	5-2½	6-6	7- 6¾
F	6½ x 12	7/8	12	2¼	8 1/8	3	7¾	6½	7¾	8¾	7 7/8	6 7/8	3-10¼	5-2½	6-7	7- 8¾

where these axles are used on new cars in passenger service, the load rating of the individual axles should be as follows:

A. A. R. axle designation	Size of journal, in.	Capacity (lb.) for axles for speeds of approximately 100 m.p.h.	Where speeds do not exceed 85 m.p.h., following capacity (lb.) may be used
A	3¼ by 7	12,000	12,500
B	4¼ by 8	19,000	20,500
C	5 by 9	25,500	27,000
D	5½ by 10	32,000	34,000
E	6 by 11	40,000	42,500
F	6½ by 12	48,000	51,000

The Joint Sub-Committee recommends that the new design of axle for 3¼ by 7-in. journals up to and including 6½ by 12-in. be submitted to letter ballot and that the letter ballot also include the ratings established for these axles when used in new passenger car equipment.

This part of the report was signed by W. I. CANTLEY, *Chairman*, Joint Sub-Committee on Axle Research.

Standard Contour for New Passenger Cars

With the advent of streamlined passenger trains, the desirability for uniform exterior appearance of passenger cars has been recognized, and this sub-committee was appointed to make

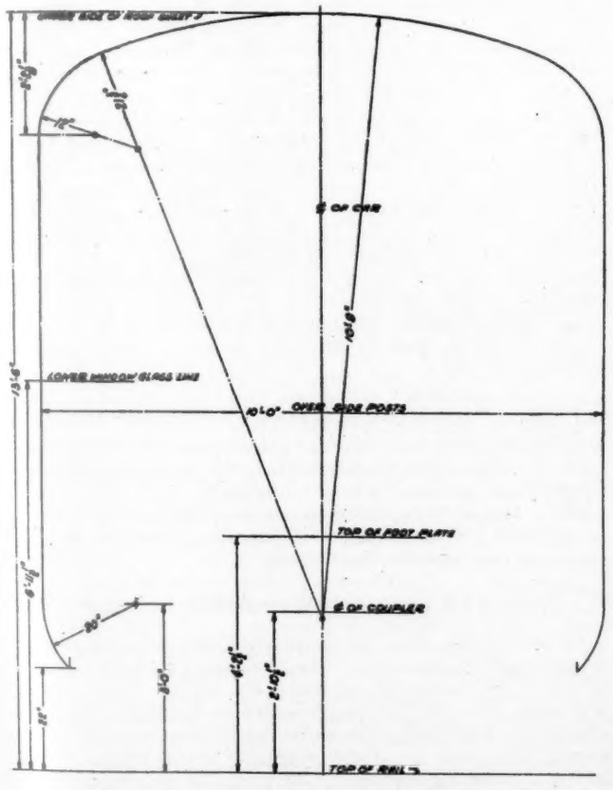


Fig. 5—Standard contour for new passenger cars

a study with a view to developing a standard contour for new passenger cars, that could be followed by railroads and car builders in the interest of improving appearance of passenger trains when cars of various railroads and Pullman equipment are intermingled.

Fig. 5 shows proposed "standard contour for new passenger cars" which has been developed, keeping in mind certain fundamentals such as cross-section of car, over-all height from rail, height of lower glass line from rail, height of foot plate from rail and width over side posts. Another drawing (not included in this abstract of the committee report) indicates the basis on which the proposed contour was arrived at.

It is recommended that contour shown in Fig. 5 be submitted to letter ballot. If approved, drawing will be prepared for inclusion in the Manual.

Lettering and Marking for Automobile Device Cars

To handle satisfactorily some of the newer model automobiles in which the width of bodies has been increased, also some of the models with considerably increased overhang from the center of the rear wheel to the rear end of the body, certain changes are contemplated or are being made in the loaders.

To take care of the wider bodies, 7 in. additional width is being provided between the front arms of the present type D loader, which results in a minimum clear width between the front arms of 82⅝ in. at a point 10 in. above the top of the wheel pan.

To take care of the automobiles with the increased overhang, the width of the rear cross frame on the Type D loader is being decreased from 16 in. to 8 in. It is the recommendation of this sub-committee that, where changes are made in the Type D loader, as referred to above, marking be used as follows:

D Plus—Latest rack having arched 26 in. wide front cross frame, 16 in. wide rear cross frame, 9 point adjustable rear hubs, telescopic front and rear legs and with front arms spread to provide at least 82⅝ in. width in the clear at a point 10 in. above top of wheel pan.

E—Latest rack having arched 26 in. wide front cross frame, rear cross frame reduced from 16 to 8 in. wide, 9 point adjustable rear hubs, telescopic front and rear legs and with front arms spread to provide at least 82⅝ in. width in the clear at a point 10 in. above the wheel pan.

The report was signed by P. W. Kiefer (chairman), chief engineer motive power and rolling stock, N. Y. C.; T. P. Irving (vice-chairman), engineer car construction, C. & O.; W. A. Newman, chief mechanical engineer, Can. Pac.; J. McMullen, superintendent car department, Erie; F. A. Isaacson, engineer car construction, A. T. & S. F.; G. S. Goodwin, mechanical engineer, C. R. I. & P.; H. L. Holland, assistant engineer, B. & O.; E. B. Daily, engineer car construction, Sou. Pac.; J. T. Soderberg, general foreman, Penna.; T. M. Cannon, engineer car construction, C. M. St. P. & P.; and F. J. Jumper, general mechanical engineer, Union Pacific.

Summary of Fourth Progress Report Passenger-Car Axle Tests

[The Summary of the Fourth Progress Report of Passenger-Car Axle Tests, issued on April 1, 1940, is appended here, as it forms the basis for the recommendations of the sub-committee on Passenger-Car Axles in the report above.—EDITOR]

In this fourth progress report the investigation of the influence of the design of the axle on its fatigue strength is practically completed except for generator-drive pulley carrying axles. Three progress reports have been issued since the initiation of the program on the fatigue testing of full size 5½-in. by 10-in. passenger-car axles. This report practically completes the testing program on six different designs of full size axles.

In all six axle designs the allowable design fatigue strength was investigated for both (a) the wheel seat with mounted rolled-steel wheel, and (b) the body portion of the axle included between the wheel seat without the presence of clamped pulleys. No investigation was made of the journal and dust-guard portions of the axle. The results of these tests are shown in Fig. 6 and Table IV.

EFFECT OF AXLE SHAPE

Summary results of all fatigue tests of full size axles for six different designs are shown in comparison with the existing axle designs in the table.

Axle Design 6 is considered as the design for the proposed new axle. It meets the practical requirements for (a) wheel-mounting tolerance conditions, (b) minimizes the scrapping of existing wheels due to having too thin a hub section, and, (c) gives an allowable design fatigue strength in the wheel seat 60 per cent to 80 per cent greater than the present design of axle (Design No. 1).

The increase in the 7-in. wheel-seat diameter of the present axle (Design 1) to 7⅞ in. in the proposed new axle (Design 6) is accountable for 25 per cent increased strength. The remainder of the increased fatigue strength obtained is due to a change in the shape of the axle wheel seat, whereby the black collar is eliminated and a raised wheel seat is formed on the axle.

All these tests on axle shape were made on steel to A. A. R. Specification M-101.

Effect of Axle Material

A total of 87 full-size axles have been tested from as-forged material to A. A. R. Specification M-101. Only a total of eight axles have been tested from normalized and tempered material to both A. A. R. Specifications M-104, Class A and M-101. The limited number of tests made on normalized and tempered axles does not justify definite conclusions at this time and additional axle tests will be made.

A number of machined axle forgings from M-101 material were originally supplied at the beginning of the axle test program for use with 8⅛-in. diameter wheel seats (Design 3). It was not found necessary to use all these axles for the original purpose for which they were intended and it was decided to test these remaining axles after turning the wheel seat for the next smaller wheel seat diameter of about 7⅝-in. (Design 2, 4 and 6).

Tests of these axles showed that the fatigue strength varied from zero to 10 per cent less than for similar axles machined from the proper forging size. Axle life is also less. It is apparent that the practice of machining smaller axles from larger axles may lead to a loss in axle fatigue strength as determined from the use of M-101 steel used in these tests.

Re-design of Axles in A. A. R. Classifications

Recommendations are contained in this report for the dimensions of the re-designed axles in classifications A through F and recommended designs of two additional axle sizes, 7 in. by 13 in., and 7½ in. by 14 in. (See Table V.) Such re-design was based on the test results of the proposed new 5½-in. by 10-in. axle known as Design No. 6.* The other axles were then re-designed to be geometrically similar to the new 5½-in. by 10-in. axle.

These proposed new axle dimensions give an increase of about 60 to 80 per cent in the allowable design fatigue strength of the wheel seat over that of the existing axle designs. The diameter of the body portion of these re-designed axles at the center is the same and the body taper is practically the same as on existing axles. It is the intention later to provide a separate design of axle in the center portion to improve the fatigue strength of the existing axle due to detrimental clamping effect of the drive pulley.

The method used in calculating the axle stresses is classified as "modified Reuleaux method." This modified method is very nearly identical to that given by the Car Construction report contained in the 1920 Proceedings of the Mechanical Division of the A. R. A. beginning on page 759. The reason for using the modified method rather than that recommended in the 1920 Proceedings is that the formulas and calculations are simplified and the resulting stresses are only about three per cent higher; also in view of the empirical nature of these formulas it is believed that this simplification is justified. Until further information is available on stresses developed in axles in road service the method used in this report is recommended.

The new axle designs when used in passenger service are calculated to have about 84 per cent of their capacity in freight service. This reduction in capacity is due partly to the fact that passenger-car wheels are 36 in. instead of 33 in. in diameter, but the greater part of the reduction in capacity results because a greater horizontal flange thrust must be assumed in order to cause overturning of a passenger car having a 54-in. center of gravity height compared with 72-in. center of gravity height assumed for freight cars. If the same horizontal flange thrust were assumed for freight and passenger cars, the axles would have about one per cent greater capacity for passenger service than for freight service because the increase in stress due to larger wheel diameter in passenger service would be more than offset by the decrease in stress due to lower center of gravity of passenger cars.

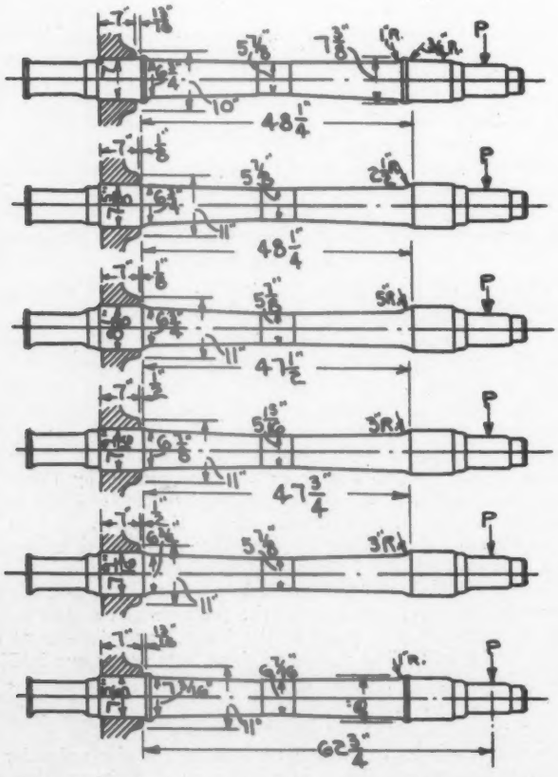


Fig. 6—Top to bottom—Axles designs Nos. 1, 2, 3, 4, 6 and 5. A summary of results of fatigue tests on these axles are shown in Table IV

Effect of Clamping Generator Pulleys on Axles

Investigation is underway on ¼ scale size axle tests of M-101 material to determine the detrimental effect on the fatigue strength of the body of the axle due to clamping of a generator drive pulley. Means of improving this axle fatigue strength are also being tested. None of these tests have progressed far enough to arrive at even tentative conclusions.

Effect of Reducing Wheel-Hub Thickness

Increasing the wheel-seat diameter on the proposed new axle designs will, in accordance with existing rules, scrap a number of wheels due to having too thin a hub section. Test of a full-size axle (Design 1) was therefore just initiated where the rolled-steel wheel-hub section was made ¾ in. thick at both hub faces. The press fit of the wheel on this axle was .0047 in., giving a mounting tonnage of 45 tons. If the test of this one wheel and axle assembly is satisfactory additional tests will be

* The dimensions of re-designed axles classifications A through F are set forth in the section on Passenger-Car Axles in the above report.

Table IV—Summary of Results of Fatigue Tests Made on Six Designs of Full-Size Axles

Axle design no.	Steel spec.	Allowable maximum axle bending stress in wheel seat to prevent: Initiation of fatigue cracks, Lb. per sq. in.	Initiation of fatigue cracks, Per cent	Breaking off of axle, Lb. per sq. in.	Breaking off of axle, Per cent	Increased axle fatigue strength against cracking in wheel seat due to elimination of black collar and use of raised wheel seat, per cent	Fatigue strength of body, Lb. per sq. in.	Fatigue strength of body, Per cent	Comparison of axle capacity: Not to crack in wheel seat	Comparison of axle capacity: Not to break in body
1	M-101	9,000	100	11,000	100	..	17,500	100	1.00	1.00
2	M-101	12,000	133	14,000	127	33	17,500	100	1.72	1.00
3	M-101	13,500	150	16,000	145	50	17,500	100	2.35	1.00
4 } 6 }	M-101	12,000	133	14,000	127	33	17,500	100	1.69	{ 1.03 1.00
5	M-101	9,000	100	11,000	100	..	17,500	100	1.29	1.26

Table V—Dimensions of 7-in. by 13-in. and 7½-in. by 14-in. Tender Axles

Size of journal, in.	Dimensions, ft.-in.														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
7 x 13.....	⅞	13	2¼	8⅛	3	8½	7	8½	9⅜	8 7/16	7⅜	3-10¼	5-2½	6-8	7-10¾
7½ x 14.....	⅞	14	2¼	8⅛	3	9	7½	9	9⅞	8⅞	7¾	3-10¼	5-2½	6-9	8- 0¾

NOTE.—For location of these dimensions see Fig. 4 included with dimensions of axles, classifications *A* through *F*, in the section of the report on Passenger-Car Axles.

necessary further to determine if it is practical to use ¾-in. hub thickness in service in order to avoid scrapping wheels.

The object of this test is:

(1) To determine if the hub of the wheel will fail with the minimum ¾-in. hub thickness shown. The reason for desiring to have this information is that the proposed new design of axle will scrap a number of wheels because of the present rules as to minimum wheel-hub section thickness.

(2) The thinner hub section may increase the fatigue strength of the axle in the wheel seat portions.

(3) The reason for machining out the wheel disc on the journal side of the axle is to determine from these tests if the light wheel-hub section will have sufficient holding power on the axle to prevent the axle pulling out of the wheel during the test.

(4) It is also desired to mount this wheel on the axle within the tonnage limits now specified for cast-iron wheels on axles instead of using the tonnage limitation now provided for steel wheels.

Discussion

In discussing this report, A. J. Krueger, superintendent car department, Nickel Plate, said that in his opinion the so-called modern lightweight steel freight car has not been in service long enough to permit evaluating all of the economic factors and mechanical details, such as initial cost, maintenance, weight saving, sizes of material, spring suspension, side bearings, brakes, draft gears, trucks, etc. Mr. Krueger said that the future design of such cars will depend upon service results with respect to full protection against corrosion at all metal joints; resistance of the material itself to distortion and rupture on account of increased flexure; degree of acceleration of such distortion or rupture resistance of the parent metal to oxidation; affinity between the parent metal and paint materials; service life as affected by the degree of welded or riveted construction employed; practicability of maintaining cars with present repair track facilities; and the resistance of the new steels to impact loading or stress at low temperatures.

Mr. Krueger congratulated the committee on its constructive report and urged further cooperation of all railroads in furnishing information regarding service performance so that the joint efforts of car builders, railroads and car operators may result in establishing the characteristics of the most economical car unit. Regarding the question of how much rigidity of flexibility should be built into a car design, Mr. Krueger said there is some question and mentioned the experience of welding pipes to cross members, bolsters, etc., in cars with results which, in his judgment, have proven to be undesirable.

K. F. Nystrom, mechanical assistant to chief operating officer, C. M. St. P. & P., offered a resolution that the committee be asked to specify the point at which the side sheet should end and the skirting begin on the passenger-car cross-section contour proposed by the committee. Mr. Nystrom offered no objection to the contour itself, but in view of the fact that some roads are not favorably inclined to the use of the skirting, felt that the location on the drawing of the point referred to would tend toward uniformity of treatment in such cases. The resolution was adopted and Mr. Kiefer said that the committee would be glad to consider the location of the point in question.

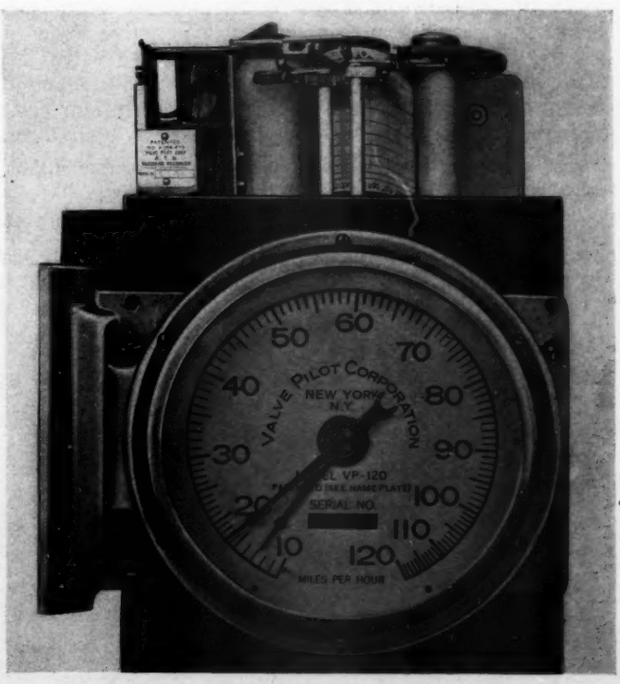
In closing this report, Chairman Kiefer said that the original standard box car of 1932 demonstrated about 20 per cent greater strength than the conventional cars with which it was checked in comparative tests and this car is generally accepted as the yardstick for durability of freight equipment. He said that car life is an important factor which must not be sacrificed for the sake of light weight and the effort has been to produce a car in which weight is saved without reducing the prospective car life.

D. S. Ellis, chief mechanical officer, C. & O., complimented the committee on producing a constructive report which obviously represented the expenditure of a great amount of time and effort. He moved that the committee be extended a vote of thanks and the report be accepted with recommendations submitted to letter ballot. *This motion was carried.*

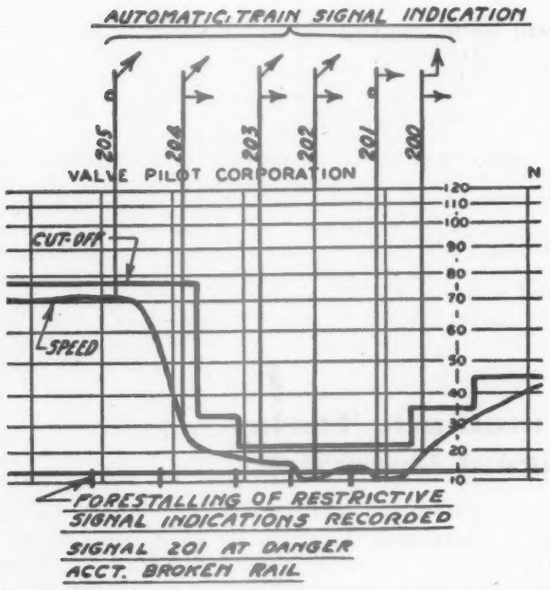
Automatic Train-Signal Recorder

A novel piece of equipment recently added to the locomotive Valve Pilot furnishes an autographic record of forestalling at restrictive signals in train-control territory. The automatic record is made on the tape in addition to its present records which show speed and cut-off.

The operation of the automatic train-signal recorder is controlled by an electro-pneumatic switch in the forestalling circuit of the train-control mechanism, the switch being closed by the admission of air to the warning whistle at the moment of forestalling. When the switch is closed the current energizes an electro-magnet located in the recording compartment of the instrument and causes a pencil attached to the armature of the electro-magnet to make a short mark at right angles to the direction of travel of the tape. Except when forestalling occurs, the pencil simply draws a straight line near the edge of the tape parallel with the horizontal ruling. The electro-magnet and pencil arm applied to an instrument are shown in one of the illustrations. The other is a reproduction of a short section of tape and indicates the character of the record when the engineman fore-



The electro-magnet and pencil arm for the automatic train-signal recorder installed on the Valve Pilot



The autographic record of forestalling made by the signal recorder is shown on the section of tape

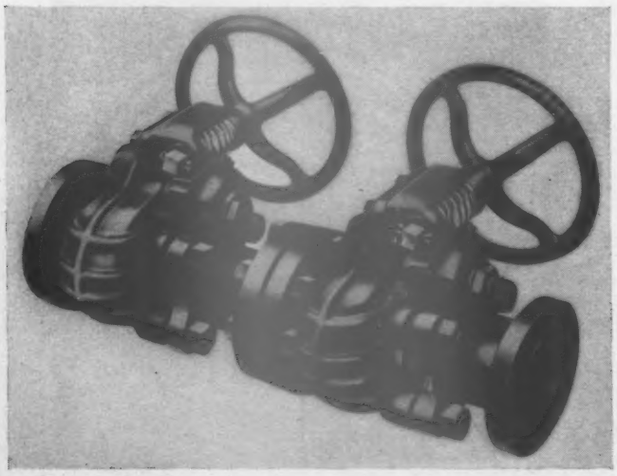
stalls at a point where a restrictive signal is encountered and the analysis of the operation.

This device added to the Valve Pilot further improves the safety of railroad operation by giving the management a written record of alertness in the observance of operating rules relating to restrictive signal indications in train-control territory. It is a development of the Valve Pilot Corporation, New York.

Blow-Off Valve for Enginehouse and Power Plant

The Okadee Company, Chicago, has recently introduced a new line of blow-off valves for enginehouse and power-plant service patterned after its locomotive blow-off valves. Threaded or flanged types of these valves are made in sizes ranging from ½ in. to 6 in. and in a single-seat design, controlling pressure in one direction, or in a double-seat style, controlling pressure in both directions. High-tensile iron castings are used in the body and outlet for low pressures and electric-steel castings for higher pressures. The valves are operated either by a lever, rack and pinion or gear mechanism. The seats and discs are available in a hardened alloy material, hardened stainless steel or Stellite surfaced.

When the valves are used in direct steam lines in enginehouses, they are equipped with chain wheels for operation from the floor. For this type of service the full opening through the valve greatly reduces the time required to empty or fill up a boiler. A complete line of these valves is available for power-plant blow-down lines, water walls, soot blowers, and other uses which are designed to meet all requirements of the A. S. M. E. Power Boiler Code.



Two Oakdee blow-off valves in combination

Unit Truck and Brake Beam

The Unit truck combines a modern high-speed truck with foundation brakes interlocked in the truck side frame. The side frames are of approved design with the bottom brake-beam guide cast integral at an angle of 14 deg. on a radial line to the center of the axle. The top portion of the guide is attached to the frame by two ¾-in. rivets. This part of the guide secures the wear plate which protects the cast guide from wear. The guide, it will be noted from the illustration, forms a socket for accepting the Unit brake beam.

The brake beam of the Unit truck operates in guides—The truck is protected in interchange by conventional brake-hanger brackets

The Unit brake beam is a solid forged truss having extended ends protected by 2⅝-in. by 5-in. wear plates forming 26 sq. in. of bearing surface. The brake beam operates in the truck-frame guides which allows for the full floating beam necessary on the flexible type of trucks. The brake head is reversible and the strut is of special design. The pin hole is bushed and the bottom of the lever slot is closed for safety. The truck has conventional brake-hanger brackets to protect in interchange.

Comparative tests of this truck with the conventional

(*Continued on page 293*)

EDITORIALS

Railway Capacity For National Defense

C. H. Buford, vice-president, Operations and Maintenance Department, Association of American Railroads, speaking at the recent meeting of the Mechanical Division at Chicago on the ability of the railroads to meet any demands placed on them by the preparedness program on which the nation seems about to enter, said that "From a careful study of our loading record during the World War and since that time, we can find no basis for an estimated loading at the peak this year that will be in excess of what the railroads can handle. Unless there is a real need for additional equipment or unless there is some economy to be gained by adding cars and locomotives, there is no reason why the railroads should buy them or put money into repairing bad-order equipment."

There is no reason to question the essential accuracy of this statement so far as the capacity of cars and locomotives to move any volume of freight which the railroads are likely to have offered to them during the present year. It is questionable whether the industrial capacity of the nation can be expanded at so rapid a rate that the railroads cannot adjust themselves to the maximum demands probable during the peak movement of the coming autumn.

There are other aspects of the situation, however, which must be faced. First, there is a distinction between the mere capacity to move a maximum volume of freight traffic and the ability to move it with economy. The latter depends upon the character of the cars and locomotives which make up the capacity. It is well known that too large a percentage of our freight motive power is of a vintage which is incapable of moving traffic economically under present-day operating conditions and there are still many old cars which are likely to require too frequent detention on repair tracks when drafted into active service.

Second, if the intentions of our national government with respect to preparedness for national defense are serious and an adequate program is carried through to completion, the industrial output of this nation will by no means reach its peak during the current year. The question arises, what of 1941 and 1942? When production schedules for armament and munitions get under way it may be far more difficult to secure deliveries on railway motive power and rolling stock needed to meet succeeding traffic peaks, each higher than its predecessor.

In a study of maximum motive power and rolling stock capacity, it is well to bear in mind that before a shortage of equipment is indicated on a national basis, local pinches will have been developing for some time on various individual railroads. Such pinches undoubtedly have been a factor in the increase in orders for locomotives and freight cars placed during the month of June when orders were placed for about 40 per cent of all cars ordered since the first of the year.

Certainly, there is not likely to be a better time than the present for those roads which can profit in economy by the purchase of new motive power and rolling stock or which are likely to need additional capacity within the next year or two to place their orders. The difficulties in the way of deliveries may very well become increasingly acute within the next few months.

Mechanical Officers Hold Excellent Meeting

The eighteenth annual meeting of the A. A. R., Mechanical division, held June 27 and 28 at Chicago, as reported elsewhere in this issue, was definitely a business session, without exhibits or entertainment features of any kind and with only one break in the program of addresses and committee reports, namely, the interjection of an educational film, "Know Your Money," by the United States Secret Service—Treasury Department, at the beginning of the second day. Some 200 railway mechanical officers were in attendance and, while some of the more or less routine reports were accepted without discussion, a number of subjects such as wheels, couplers, loading rules, and car and locomotive design developed many pertinent comments of definitely constructive character. The meeting was ably presided over by Chairman F. W. Hankins, assistant vice-president and chief of motive power, Pennsylvania. Vice-Chairman W. H. Flynn, general superintendent motive power and rolling stock, New York Central, did not have much to say, but evidently was making mental notes for use in guiding the affairs of the division during the coming years.

In general, the reports of the eleven standing committees were unspectacular, at least from the point of view of the lay reader who must have war news or at least a murder or a divorce headline to attract his interest in a newspaper. It may be said without fear of contradiction, however, that these reports, almost without exception, dealt with matters of vital importance to the safety and economy of rail transportation, and it is no reflection on, but rather a tribute to, the railway officers who know most about these things that they

discussed them both quietly and competently and in a most matter-of-fact fashion. Probably few people outside the ranks of the Mechanical division, itself, realize just how much time and effort are expended by the General committee and various standing committees in preparing for these annual meetings and how much good judgment and experienced supervision of a vast amount of details must be exercised by Secretary V. R. Hawthorne and his office.

Among the outstanding jobs done by the A. A. R., Mechanical division, during the past year was the continued revision of the interchange rules to promote the more expeditious movement of freight traffic and the re-adjustment of labor, material and overhead charges so as to eliminate profit from foreign car repairs. Loading rules were studied and revised especially with a view to the more safe and at the same time economical loading of open-top cars. The discussion indicated that all railroads have not helped as much as they should by reporting the adjustment or transfer of loads. In view of the need for more prompt application of improved loading practices, it was decided that necessary revisions in the loading rules should be approved at the annual meeting or at General Committee meetings throughout the year without the delay involved in submitting them to letter ballot. This is an evidence of the adjustment of mechanical-department officers to the needs of the railways in their competition for traffic with highway transportation agencies.

An exceptionally interesting subject presented at the annual meeting this year was the results to date of the passenger-car-axle research program, being conducted at the laboratory of the Timken Roller Bearing Company under the direction of W. I. Cantley, mechanical engineer of the division and a special joint sub-committee. This work has led to a redesign of passenger-car-axle wheels seats which, partly as the result of the increase in wheel-seat diameter and partly as the result of the elimination of the black collar included on current designs, has increased the allowable design fatigue strength of the wheel seat about 60 to 80 per cent over that of the existing axles. This means much for the future reliability and economy in high-speed passenger-train service. The division has other pertinent investigations in prospect and it is gratifying to note that the potential importance of research activities heading up in the mechanical engineer's office has been recognized by recently giving Mr. Cantley an experienced assistant.

The division reports progress in providing dies for the manufacture of parts for the A. A. R. design of auto deck which has been demonstrated at practically all automobile-loading docks; consideration is being given to developing a standard clearance outline for interchange freight cars; in co-operation with other divisions of the A. A. R., studies are being made of (a) the effect of light cracks around refrigerator car doors and hatch plugs, (b) use of dry ice in refrigerator cars, (c) use of portable refrigerator containers for l. c. l. shipments. The results of the A. A. R. high-speed freight-car track tests are expected to be released some time this month.

Diesel Locomotive Operating Costs

In presenting its report to the railroad industry, and to others that may be interested in the question of the cost of operating Diesel-electric locomotives, the sub-committee of the Locomotive Construction Committee of the Mechanical Division has done a worthwhile job in the tabulation of the cost of operation of switching locomotives. Such reports as these are especially valuable in connection with the operating results obtained by the use of a facility that is relatively new in the industry and concerning which there has been a considerable amount of controversy during the initial years of its installation.

The controversy is by no means settled in the minds of many railroad men who are unwilling to concede what now seems to be definitely established advantages in favor of the Diesel locomotive in specific classes of service. Herein lies the real value of the work that has been done by a committee such as has presented this year's report—it has added to the sum total of our factual information concerning a phase of railroad operation that is going to be of vital importance to the future of the industry.

The statistical information contained in the sub-committee's report concerning installations of Diesel locomotives is of interest in several respects. It shows that at the beginning of this year 749 Diesel locomotives had been installed on the railroads and that 57 more were on order. Of the 749 locomotives in service 681 are units of 1,000 hp. or less, and all but 11 of this large group are in switching service. There are 40 locomotives in the group from 1,000 to 2,000 hp., six of which are switchers and the remaining 34 are road locomotives. In the horsepower ranges above 2,000 all of the locomotives are in road service and there are 28 locomotives in that group.

The installation statistics show some interesting trends in the switching field. Up to 1931 most of the switchers were of from 300 to 400 hp. At that time 95 units in that horsepower range had been installed as compared with only 19 in the 600 hp. class. It is probable that most of the 600 units of that time were two-engine locomotives powered by a pair of 300 hp. engines. From 1932 to 1936 the trend was definitely toward the larger units, for in that five-year period 65 switchers of 600 hp. were installed as compared with only 7 of the 300-400 hp. group. It was in this period, too, that the development of the larger engines made possible the construction of single-engined switchers and with this development the 600 hp. unit really came into its own and established a popularity which has been on the increase ever since, as witnessed by installations of 87, 50 and 107 respectively for the years 1937, 1938 and 1939. Added to this group are 25

units of 660 hp. During the same period 79 switchers of 900 hp. were placed in service.

So much for the statistical side of the committee's report. It is of interest as an indication of the increasing importance of the Diesel locomotive in the rail transportation field and also it establishes certain facts that have a bearing on any statistics concerning the cost of Diesel locomotive operation.

An analysis of the cost figures developed by the subcommittee in the 1940 report presents some interesting indications of what may be expected in the future as far as the cost of this type of motive power is concerned. The tabulation of costs, for a six-months test period in the year 1939, is also of interest when compared with the similar tabulation which was a part of the 1939 report to the Division. The 1940 report includes comparative costs of 600 and 900 hp. locomotives, while the 1939 report included only the 600 hp. units. All of these cost figures relate only to switching locomotives. The 600 hp. switchers operated 87.8 per cent of their assigned hours. The actual total hours operated by 71 units on eight roads was 262,868 and for this service the fuel oil average was 5.63 gal. per hour and the lubricating oil average was .13 gal. per hour. This would indicate a fuel cost of close to 30 cents per hour.

In the 1939 report 51 units operating a total of 1,227,888 hours averaged 6.591 gal. of fuel per hour and .1244 gal. of lubricating oil per hour. These figures may indicate a change in the load factor for 600 hp. switchers as between the two years or they may indicate the influence of the more modern and more efficient prime movers in switchers recently installed.

The 900 hp. switchers operated 91.6 per cent of their assignments for a total of 101,762 hours, on six different roads. The fuel consumption averaged 6.371 gal. per hour and the lubricating oil average was .1606 gal. per hour. Here we have an indicated average of about 33 cents per hour for fuel and 8 cents for lubricating oil. These figures can hardly be questioned and they provide a reliable base for building up 900 hp. total cost figures.

The maintenance cost figures are certain to be of greater interest, for here is where some of the controversy lies. In the 1939 report the average cost for maintenance of 51 locomotives of 600 hp. was $0.5726 per hour. The 1940 report gives the cost (over a six-months period) for the same size of locomotive as $0.3038 per hour, and for the 900 hp. unit as $0.2755. If cost studies for short periods of service are an accurate indicator then the principal conclusion to be drawn from these figures is that the greater age of the 600 hp. switchers now in service is bringing them into the periods of major repairs and that the more modern units are considerably less expensive to maintain than the older ones.

It is to be regretted that the cost studies in the 1940 report did not embrace "enginehouse expense" and miscellaneous cost items. These are needed to complete the picture and may prove of great value in the future as the installation of Diesel locomotives continues to be made.

In one respect the closing remarks of the sub-committee in the 1940 report leaves us with mixed feelings, for they say that "it is felt that sufficient information is available to justify consideration of suspension, for the present, at least, of activities of this committee, and it is so recommended." Whatever may be the reason for suspending the activities of this sub-committee—and the report was accepted by the Division—there are a multitude of people interested in the economics of Diesel operation who will take issue with any assumption that sufficient information, of an accurate character, is available to meet the needs of future studies.

It may be true that operation cost studies are somewhat outside the function of the Locomotive Construction Committee but there is a strong feeling on the part of many railroad men that a permanent study of costs should be set up and it is to be hoped that the A. A. R. will recognize this. The interest of the American Society of Mechanical Engineers in Diesel locomotive costs is evidence that the job is by no means done; in fact it has only started.

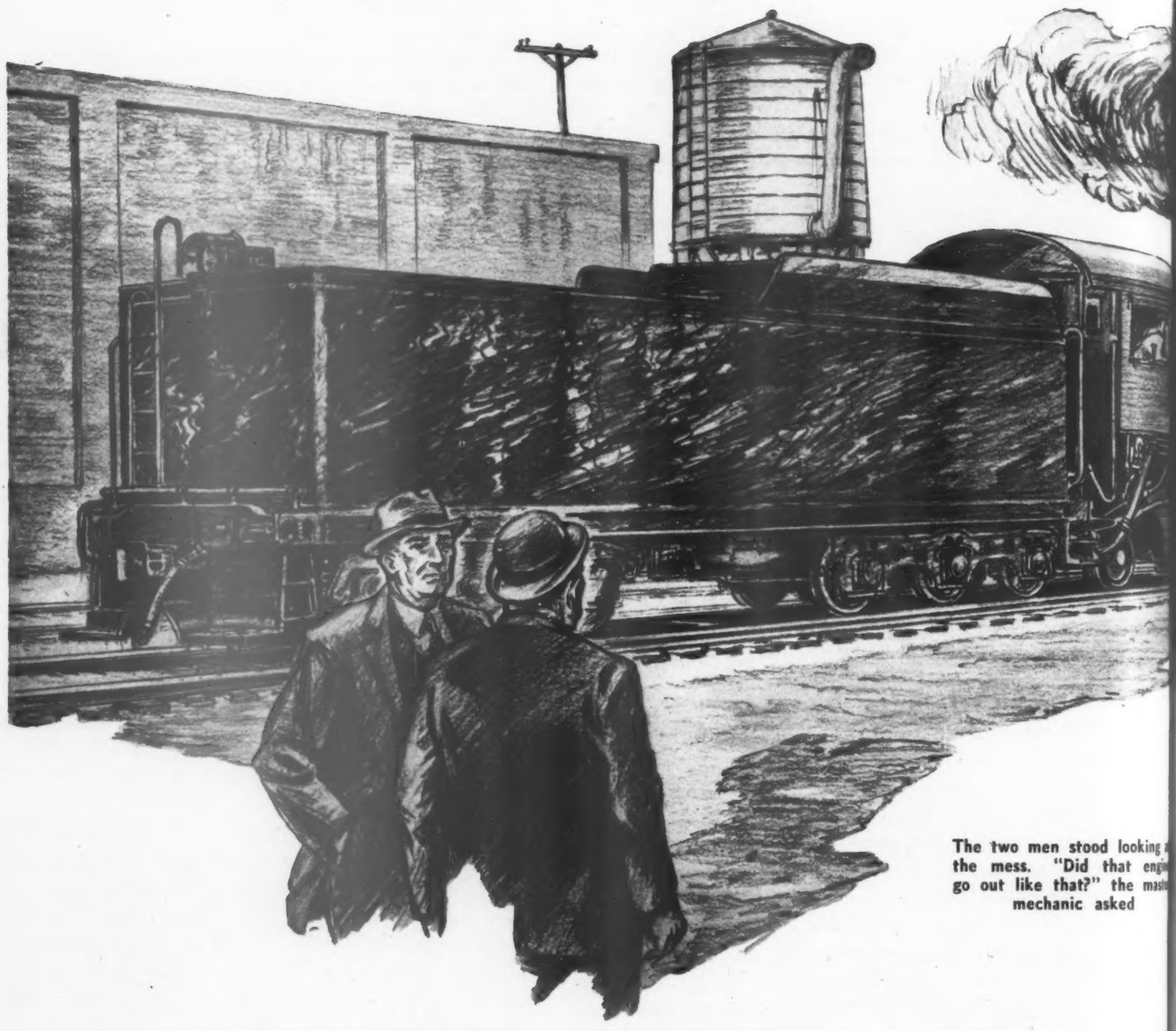
New Books

A Dictionary of Metals and Their Alloys. *Edited by F. J. Camm. Published by the Chemical Publishing Co., Inc., 148 N. Lafayette St., New York. 245 pages, 5½ by 8½ in. Price, $3.*

This book contains descriptions of the metals, their composition and characteristics, with special sections on plating, polishing, hardening and tempering, metal spraying, rust-proofing, and chemical coloring, and useful tables. It is believed to be the first alphabetically arranged dictionary of metals and their alloys yet published. It is cross-referenced throughout and, where necessary, historical facts have been included.

Proceedings Association of American Railroads, Mechanical Division, 1938-39. *Published by the association, 59 E. Van Buren street, Chicago. 780 pages. Price to members $5; to non-members $10.*

The sessions of the Operations and Maintenance Department, Mechanical Division, held at the Hotel Commodore, New York, June 28-30, are covered in the 1938-39 proceedings, also recommendations, letter ballots and other transactions for the two years. The subjects reported on at the New York meeting were lubrication of cars and locomotives; specifications for materials; wheels; brakes and brake equipment; arbitration; prices for labor and materials; tank cars; loading rules; couplers and draft gears; car construction; reciprocating steam locomotives, and utilization of locomotives. Bound in at the back cover of the proceedings are Summary Sheets of Operating Statistics, Class I Railroads, Year 1938 compared with Year 1937, which formed a part of the report of the Committee on Utilization of Locomotives.



The two men stood looking at the mess. "Did that engine go out like that?" the master mechanic asked

Water On The Troubled Oil

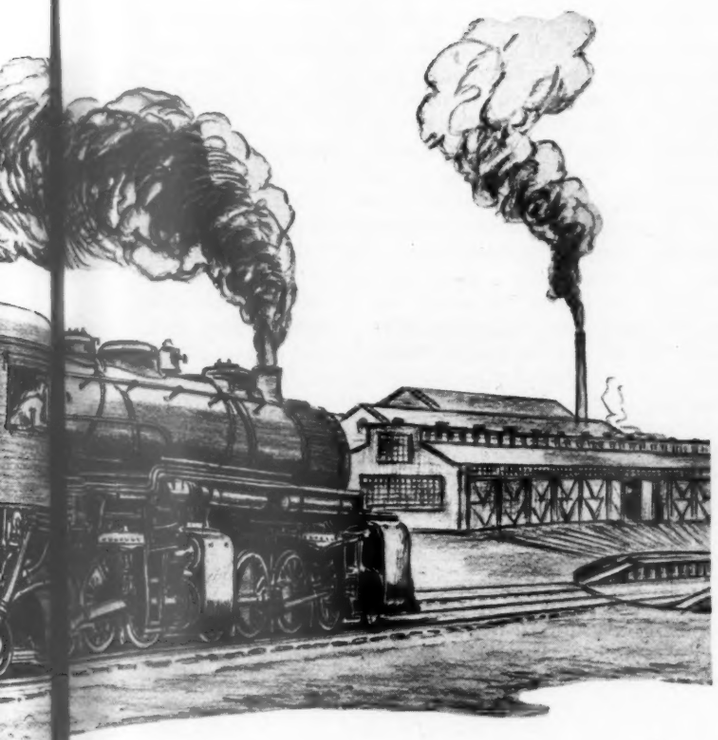
by
Walt Wyre

THE S. P. & W. was one of the first railroads to begin burning oil in locomotive fire boxes. Like all pioneers, they had considerable trouble when they first began using the sticky black liquid—at least it's a liquid when it's hot. They still have some trouble, usually just trifles but enough to provide an alibi for firemen and small enough to be repaired without a great deal of work.

No one on the S. P. & W. knew very much about firing with oil when they began. Jack Phillips, the fuel supervisor knew plenty about coal. He cut his teeth on a hunk of soft coal and used a worn out scoop shovel for a stick-horse when he was that age. Jack learned a lot about burning oil and he learned something else doing it. He learned that just because a kid is fresh out of college is no sign that there are no sensible ideas in his head.

Jim Evans, the roundhouse foreman at Plainville, almost went nuts while the change from coal to oil was being made. Most of the work was done at Plainville and dragged along for about a year. The engines being converted took up roundhouse room that was needed for running repairs and boilermakers were so busy on the new work that they didn't have time to keep the boiler work up on other locomotives.

Martin Caldwell, a kid with the ink not yet dry on his college diploma, was sent to Plainville to help Phillips work out various problems that might come up with the new fuel. Martin was a chemistry major and had made a specialty of petroleum. The two didn't hit it off from the start; at least Phillips didn't like his assistant and didn't care who knew it, Caldwell included. Martin was agreeable to everybody and if he knew he was being ridden never let on. He fixed up a laboratory in one corner of the cubby hole they gave him for an office and spent considerable time fooling with flash cups, Bunsen burners, thermometers, and things like that. He



had a lot of instruments Phillips couldn't even pronounce the names of.

One day the fuel foreman went into the combination office and laboratory while Martin was testing samples of a new lot of fuel oil. The assistant was watching a stop watch with one eye and the instruments with the other.

"What's that thing?" Phillips asked with a sneer in his voice.

"It's a viscometer," Caldwell replied without taking his eye off the instrument. A drop fell and he made a note of the time in a little black book.

"What the hell is a vis—vis—that thing—supposed to do?—fire a locomotive?"

"No," Martin replied evenly, "it tells the viscosity of the oil at various temperatures—how hot it has to be to flow." He took another sample of oil and placed it in a flash cup and set the cup in a wire frame over a gas burner. He then stuck the bulb of a thermometer in the oil.

"What are you doing now?" Phillips asked in a tone that indicated that whatever the chemist was doing would be just as well left undone.

"Testing the flash point." Martin watched the oil and thermometer. He struck a match and held the blaze over the cup of oil.

"Even you ought to know that you can't set that stuff a-fire holding a match over it," Phillips scoffed. "It won't hardly burn if you pour kerosene over it."

Every few seconds Martin tried to see if the oil would flash. When bluish vapor curled up from the oil he tried again and the vapor ignited. Martin made another notation in his book and kept on heating the oil. He continued to heat the oil until it could be lighted and continue to burn. Then he turned off the gas from the burner and extinguished the burning oil by slapping a piece of cardboard on top of the cup.

"Now I guess you can go out and fire a locomotive with it," Phillips said.

"There are certain specifications required when we buy oil," Martin replied, "and I was just making certain that it meets those requirements. This is pretty good oil. It's from the Carborex Company. Their oil seems to be better than any of the other I've tested."

"Have you tried it in a locomotive?" With that shot, Phillips turned and left the office.

THE 5091 was the first engine finished. Phillips and his assistant both rode it on the first trip.

The engine didn't do so good with the ninety-two loads the dispatcher hung on it. Try as he would, the fireman couldn't keep steam. When the oil valve was wide open, the locomotive smoked like a tar kiln and before they reached Sanford hunks of carbon had accumulated in the channel in front of the burner. They had to stop and raise steam to keep from doubling Clear Creek hill.

When the fireman couldn't make a go of it, Phillips took the seat on the left side and tried it. He jiggled the fuel valve, tried different amounts of steam on the atomizer valve, but the engine just wouldn't steam. He swore a streak that should have made the boiler pop, but it didn't.

"Why don't you do something?" he yelled at Martin. "Maybe if you had a test tube and a thermometer you might make this blamed stuff burn! Why don't you do something?" he yelled again.

"Nothing we can do until we get the engine to a shop," Martin replied.

"Maybe you think you know what's the matter with it," the fuel foreman said sarcastically.

"Yes," Caldwell replied, "at least I know partly why it isn't steaming. It's not getting enough air and the burner is set too low. That's part of the cause for the carbon in the channel. Giving it more oil than will burn only makes it worse," he added as Phillips yanked the valve.

Phillips wanted to cut the 5091 out at Sanford.

"I believe if we cut a couple of slots about two inches wide and twelve inches long on each side of the boot and raise the burner a little it might do better," Martin suggested.

The fuel supervisor started to argue, but changed his mind and said, "O. K., if you want to be responsible for the delay. We've already fell down over an hour."

A machinist using a cutting torch cut the openings in the boot under the direction of Martin. The same machinist adjusted the burner so that the spray of steam driven oil was slightly higher. Phillips stood by and watched. The expression on his face showed very clearly that the whole business was just some more of his assistant's tomfoolery.

The carbon was cleaned out of the channel and Martin said he believed the engine was ready to go. Phillips lighted a ball of oily waste and threw it in the firebox and started to take hold of the firing valve.

"If you don't mind, I'd like to try firing her awhile," Martin said as he edged over to the left side of the locomotive and very innocently got between Phillips and the valve.

"Why you young cub!" Phillips came very near letting his temper get away for a moment, "I was firing a locomotive before you quit wetting the bed!"

Martin's eyes flashed, his face reddened. There was trace of a tremor in his voice, but he spoke evenly. "You said that I was to be responsible."

"O. K., she's your baby!"

The 5091 did better the rest of the trip. The train

made running time, but failed to make up any that had been lost between Plainville and Sanford. All of the other engines that came out later had slots in the sides of the boot, though; the fuel supervisor saw to that.

After the trip with the 5091, Phillips eased up on his assistant a little and was even known to ask Martin's opinion on a few points. One day Phillips came in Martin's office carrying a bucket of oil.

"Test this and see how it shows up," Phillips requested.

The chemist started immediately. "This is not Carborex, is it?" he asked after examining the oil.

"What difference does it make?" Phillips asked sharply. "Oil is oil, isn't it? I made a pretty good deal for this oil from an independent company. We get all of their business if we buy their fuel oil. Their chemist said it would test better than what we are getting from the Carborex people."

"If you mean flash, viscosity and fire, it does show better, but I would suggest that you don't mix it with Carborex oil."

"Does it come up to our specifications? That's all I want to know," Phillips asked testily.

"Yes," Caldwell replied, "but I still say it's not a good idea to mix it with Carborex oil."

The independent refinery couldn't supply but a small percentage of the fuel oil required by the S. P. & W. They continued to buy most of the oil from Carborex Company with occasional cars from the independent. Disregarding the chemist's advice, fuel oil was dumped into storage tanks indiscriminately as received. Sometimes there was a complete tank of oil from one or other of the two companies, but usually the oil was mixed in varying proportions.

When the first oil was received from the independent company, the fuel supervisor observed closely to see what happened. He rode an engine that started out with a tank full of the new oil. The oil seemed to burn nicely and the fireman had very little trouble keeping steam. It showed a tendency to form more carbon than usual, but Phillips laid that to the way the burner was adjusted.

SIXTY days passed without any unusual trouble and Phillips forgot all about what his assistant had said when he tested the oil. Then one day a fast freight stopped at Middleton to take oil and couldn't get any. The oil wouldn't run. They lost an hour trying to take oil and finally set out half the train and started to Sanford. The Sanford goat met the train seven miles out and brought it in.

A water service man was sent post-haste to locate the trouble with the fuel oil at Middleton and correct the trouble. He reported that there was sediment in the tank deep enough to clog the inlet pipe of the centrifugal pump used to pump the oil to the oil crane. He raised the pump six inches and reported the station O. K. for service. Two weeks later there was a similar occurrence at Sanford.

In the meantime, Jim Evans was having some troubles of his own. Almost every engine that came in had almost as much oil on top of the tank as it did inside. The enginemen complained that the tops of the tanks weren't properly cleaned.

The master mechanic wrote a couple of hot letters about the condition and also began to watch. He was at the roundhouse when the 5082 came in looking like the tender had been dunked in a vat of hot oil. Evans was with him at the time.

The two men stood looking at the mess. "Did that engine go out like that?" the master mechanic asked.

"No," Evans replied. "It was fairly clean and it's going to take all of the laborers I've got eight hours to get it clean again. Chances are all of the paint will come off with the oil when we clean the sides of the tank," Evans added.

"This has gone about far enough," the master mechanic snapped. "And, I'm going to find out what is causing it, and stop it. I believe the truth of the matter is the firemen are getting the oil too hot and boiling it over."

Before the official had time to locate the correct the cause of the condition, however, the superintendent got in on it, and things happened fast. The Limited pulled into the station at Plainville. The superintendent didn't notice the oil on the engine tank, but he did notice the black mess splotched all over windows and sides of the passenger cars. He immediately sent for the engineer and fireman that came in on the engine pulling the Limited.

"How in the world did you manage to scatter oil from one end of the train to the other?" the superintendent asked the engineer and fireman.

The two stood uneasily looking at each other. Finally the engineer said, "The tank boiled over and the wind was blowing just right when it happened, and we were making pretty good time."

"There's no excuse for getting oil so hot it boils over," the superintendent said. "I'm going to take you both out of service pending an investigation."

"But the oil wasn't so very hot," the fireman said. "Of course it boiled over, anybody can see that, but it wasn't very hot."

"I'll have the investigation in the morning at eight o'clock," the superintendent said. "You are not due to get out until tomorrow afternoon, are you?" He picked up a letter and the men walked out.

After the enginemen had left, the superintendent called the fuel supervisor and asked him to come to the office.

"I want you to come to an investigation in the morning at eight o'clock," the superintendent said, "and if you can, explain why the epidemic of fuel oil trouble we are having."

Phillips left the office without saying anything. He didn't know just what to say. There was a haunting memory of what Martin Caldwell had said about not mixing oil from the independent company with that from the Carborex, but he couldn't for the life of him connect up that with the present trouble. He went to his office and sat nearly an hour trying to figure out what to do. Suddenly he jumped up and went into Caldwell's office, something that he seldom did.

"We've been having a lot of trouble with fuel oil lately," Phillips said, "and the superintendent wants to know the reason." Phillips paused for an answer, but all he got was, "Yes, sir."

"It's that damned oil from the Carborex Company and that's what I'm going to tell the superintendent!" Phillips sputtered.

Martin didn't say anything.

"You didn't like it when I made the deal to get oil from another company, yet you said yourself oil from the independent company showed a better test than Carborex."

"I said they shouldn't be mixed," the chemist replied.

"You might come down to the superintendent's office in the morning and see if you can explain what mixing the oils has to do with tanks filling up with sediment, oil boiling over, and other troubles we are having." Phillips strode out of the room.

"I'll be there," Caldwell said, and if Phillips hadn't been so busy nursing the huff he had, he would have detected a note of elation in Martin's voice.

NEXT morning at eight o'clock the two enginemen and a representative from their brotherhood were in the superintendent's office. The master mechanic heard of the investigation and he was there also. Phillips came in a few minutes after eight. Caldwell hadn't showed up.

Just as the superintendent started to ask the usual preliminary questions, Martin Caldwell came in carrying a large case something like enginemen use.

"Leaving?" Phillips asked in a tone that wasn't entirely joking.

"Maybe," Martin replied as he set the heavy case down carefully.

"What have you got there?" the superintendent asked.

"Mr. Phillips said you wanted to know what caused the oil to foam."

"Can you tell us?" the superintendent asked.

"I believe I can show you," Martin said mildly.

"Well, in that case, with these gentlemen's consent, I'll postpone the investigation until you show us the cause of the trouble." The superintendent indicated the engineer and fireman.

"Go ahead," the representative said.

Caldwell somewhat nervously began to unpack a formidable array of containers, thermometers, and other paraphernalia, including three alcohol lamps. As he worked, his nervousness disappeared.

"We've been getting oil from two different companies," he began. "One of these oils is cracked oil, the other is not."

"He is," Phillips whispered to the master mechanic loud enough for all to hear.

"Will you explain the difference?" the superintendent asked.

"Yes, sir," Martin poured some oil in two glass cups. "This one is cracked oil, meaning that the gasoline, kerosene, distillate and other more volatile products have been removed by refining; the process is called cracking. This is crude or uncracked oil."

Phillips started to say something, but a look from the young chemist changed his mind and he decided to keep still a little while and await developments.

Martin placed an alcohol burner under each glass cup of oil. Then he filled another cup with a mixture of equal parts of cracked and uncracked oil.

Every one in the room watched as the three containers of oil began to heat. There was a thermometer in each cup of oil. The temperatures of each reached 100 degrees; nothing happened. It got hotter and still nothing happened. At 180 degrees all three cups of oil were giving off blue vapor but nothing else happened.

Caldwell, as unconcerned as though he were alone in the little laboratory in the office, watched the thermometers and said nothing. At 212 degrees nothing had happened.

Then Phillips broke the silence. "I thought you were going to explain what caused the oil to boil over. It's past the boiling point right now and hasn't boiled over."

"Please be patient," Caldwell said. "In the meantime, I might explain that there will be a little deposit of substance like asphalt in the cup containing the cracked oil; there will be more in the one of uncracked oil and there will be considerably more in the mixed oil."

Phillips began to squirm and wanted to get off that particular subject. He jumped on the one first mentioned. "If you'll be good enough to explain what causes boiling over."

"Yes, sir," Caldwell said civilly. "Would you please spit in one of the cups of oil?"

"Spit in it?"

"Yes, it makes no difference which one."

Phillips started to argue, but the superintendent's expression stopped him. He leaned over and spat in the cup of Carborex oil that the thermometer showed had reached 300 degrees Fahrenheit.

When Phillips spit, the oil seemed to explode. The black liquid flew all over his clothes, spattered the front of his shirt, and a few drops hit his face. One drop would have gone in the fuel supervisor's eye if it had not been for his glasses.

"What in the hell is the idea?" Phillips sputtered. "If that's your idea of a joke!"

"That's what's been causing your oil to boil over—water. Water and oil don't mix and every time oil boils over, you can bet it was caused by water."

"What's mixing the two oils got to do with it?" the master mechanic asked.

"Well," Martin said, "it will take a little time for a thorough demonstration, but maybe I can give you an idea. Mixing uncracked oil with cracked oil and heating the mixture causes more precipitation of a substance like asphalt and it is partly asphalt. That deposit filled the supply tanks. It has also coated the heater coils in the tank. It is a very good material for building roads, but is a poor conductor of heat. As a result, the heater coils insulated with this aphaltic deposit don't do a good job of heating the oil and firemen are forced to use a steam jet from the open heater; hence, water in the oil. If you care to take these three cups of oil after they are cool, you can see for yourself," Martin said to Phillips.

"No, thanks, I'll take your word for it."

"There won't be any investigation," the superintendent said. "Sorry to have bothered you men." Then to Martin: "Thanks for your entertaining exhibition, but I'm wondering why you didn't say something about all of this sooner."

"Well," Martin again showed symptoms of nervousness, "the trouble came on so gradually that it kinda slipped up on us."

Phillips took such a deep breath it made him cough.

Unit Truck and Brake Beam

(*Continued from page 286*)

A. A. R. truck and brake beams were made at Johnstown, Pa., in August, 1939, under the supervision of the A. A. R. The single car break-away test was used under identical conditions. The tests were made at speeds of 10 to 50 m. p. h. with service brake applications of 10 and 22 lb. per sq. in. brake-cylinder pressure and at full emergency applications with the result that the Unit truck produced a 5.9-per cent higher brake-rigging efficiency. It was found that this truck was particularly efficient in the higher range of speeds and that the Unit brake produced 11 per cent more shoe bearing than the conventional type.

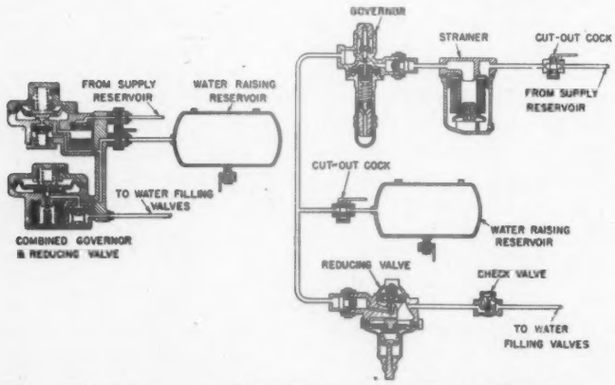
In switching service after 2,500,000 brake applications the brake beam of a Unit truck showed negligible wear. One of these trucks under an auxiliary water car after 130,000 miles in high-speed service showed 0.03-in. wear on the brake-beam wear plate and 0.02 in. on the side-frame wear plate. No measurable wear was found after 400,000 miles in refrigerator-car service and after 25,000 miles under tank and chemical cars.

Service tests indicate that these trucks will not only increase the braking efficiency, but will greatly prolong the life of the car wheels as the toggle action of the

hanger type of brakes is absent in this guided brake beam. It thus tends to eliminate brake-skid spots on the wheels. A further indication of the efficiency of this type of brake is that in 800,000 miles, all brake shoes were reported to be wearing full and even and none had been found broken. This equipment is made by the Unit Truck Corporation, New York.

Combined Governor And Reducing Valve

The Westinghouse Air Brake Company, Pittsburgh, Pa., has developed a combined governor and reducing valve for water-raising systems. It has the same functions as the present arrangement of separate devices, but is simpler to install and less expensive to maintain. The



The combined governor and reducing valve shown at the left performs the same functions as the old standard arrangement of separate devices for the water-raising system shown at the right

two valve portions are assembled on a common bracket which makes this arrangement more compact, conserves installation space and permits the removal of operating parts for inspection, cleaning and testing without disturbing pipe connections. To facilitate installation and minimize air leakage, flange unions are furnished.

Two cut-out cocks, operated simultaneously by a single handle, are attached to the pipe bracket which allows for the removal of portions without first exhausting the air from the water-raising system. The operating pressure of each valve is permanently set before shipment, thereby insuring against any change in adjustment in service. Protective air strainers of curled hair and felt are installed in the inlet passages and the spring-chamber vent ports have wasp excluders. Two Wabco non-return check valves in series, one in the governor and one in the reducing valve, prevent the back flow of water to the air-brake system.

Four-Wheel Truck for Passenger Cars

A lightweight passenger-car truck of the four-wheel single drop-equalizer type has been designed and equipped by the General Steel Castings Corporation, Eddystone, Pa., to produce improved riding conditions. It has coil springs in both the equalizer and bolster positions and is furnished with shock absorbers and bolster anchors. The use of coil springs throughout

The Commonwealth four-wheel truck

eliminates the inter-leaf friction present in the usual type of elliptic bolster springs, allows for ample spring deflection, and thereby improves the riding qualities.

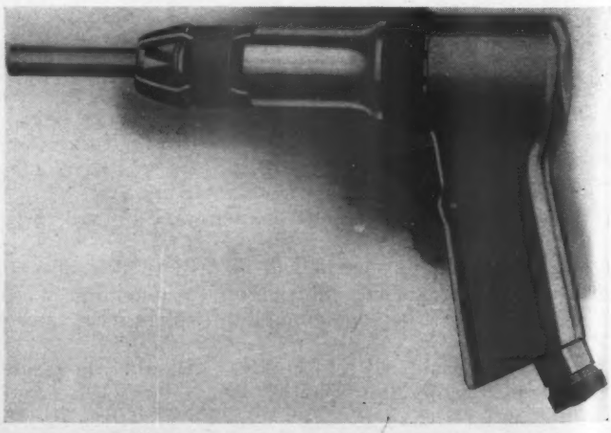
The increased spring action is controlled by one-way shock absorbers mounted at each end of the bolster. Positive cushioning and a reduction in noise is obtained, wherever practical, by the use of insulation which minimizes the metal-to-metal contact of the working parts of the truck. The bolster anchor arrangement replaces the conventional bolster and truck-frame chafing plates. It is applied on each side of the truck, being supported at one end by an integral bracket on the truck frame, the other end being attached to an integral bracket located on the extended end of the bolster. This maintains the bolster in its proper position and eliminates the wear on the chafing plates and the objectionable pounding between the bolster and frame.

Light weight with the necessary strength is made possible by the use of low-carbon nickel-alloy steel for the truck frame and bolster. Trucks of this design are in service under many cars in lightweight streamline trains where smooth riding with freedom from vibration and lateral sway is demanded.

Air-Operated Riveting Hammer

A lightweight air-operated riveting hammer for use in the fabrication of iron, steel, and aluminum products has been announced by the Ingersoll-Rand Company, Phillipsburg, N. J. It is known as Model AV and is available in two types. One is a short-stroke fast-hitting model for ordinary use, and the other is a long-stroke slow-hitting hammer designed primarily for aluminum, dural or soft iron rivets. Both are available with either a pistol grip, an offset, or a push-button handle.

They can be adapted for very light chipping, scaling, and calking work when equipped with the proper chisel.



The Ingersoll-Rand AV-12 slow hitting hammer with offset handle

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High Spots in
Railway Affairs . . .

Over Roosevelt's Veto

President Roosevelt, during his first campaign for the Presidency and several times since, has indicated that the railroads should be given remedial legislation and, yet, now that he is nearing the end of his second term, the Administration has little constructive railroad legislation to its credit. One small piece of such legislation, however, has just been put through *over his veto*—the so-called bridge bill. It relieves the railroads of the cost of rebuilding bridges required to be altered in connection with waterway projects. The vote in the Senate was 65 to 17 and in the House 324 to 68. Even Representative Culkin of New York, a waterway advocate, supported the bill. Said he, "I am glad at this time to be able to say a positive word in behalf of the railroads. I think their rights are definitely and unfairly invaded under the present law and this legislation offers a positive cure in the situation."

Rewards for Safety Performance

The E. H. Harriman Memorial Medals have been awarded under the auspices of the American Museum of Safety to those Class 1 railroads having the best safety records for the year 1939. The South-Central district of the Union Pacific was awarded the gold medal in Group A—those roads operating 10 million or more locomotive-miles per year. The Chicago, St. Paul, Minneapolis & Omaha was given the silver medal in Group B, which includes those railroads operating from one to 10 million locomotive-miles a year. The Charleston & Western Carolina was the winner of the bronze medal in Group C, those roads operating less than one million locomotive-miles a year. A special safety award was made to the New York Central System for having operated more than 16 consecutive years without a passenger fatality in a train accident, with a total of 50,463,685,000 passenger-miles. Samuel O. Dunn, editor of the Railway Age, pointed out that the great increase of railway safety since the beginning of the century has been due to improvement of railway operating rules and methods and to the improvement of railway plants, but principally to educating employees and securing their co-operation. "A great majority of railway and all other accidents," said Mr. Dunn, "always were and still are due not to shortcomings of rules or plants, but to man-failures, and the great achievement of railway managements and employees has been that of getting railway personnel to observe constantly in all its many kinds of work, the fundamental rule of safety first."

Trucking Tonnage Up

May was a record-breaking month for motor truck transportation. Reports made by the American Trucking Associations covering 184 motor carriers in 37 states and the District of Columbia, show that the May volume was 5.3 per cent above that for April and 12 per cent above that for May, 1939. Car loading reports for the month of May showed that railroad traffic was 15 per cent ahead of the same month last year.

S. 2009

The railroad brotherhoods having sabotaged the Omnibus Transportation Bill S. 2009 and sent it back to conference, Congress shows no disposition to go out of its way to pass a bill at this session—a session, by the way, which would have ended before this had it not been for developments abroad and the pressing need for national defense legislation. Railroad labor, or rather, the leaders of the railway unions, insist upon a retention of something of the Harrington "labor-protection" amendment. With all the political excitement of a presidential election year there is little possibility of getting it out of conference unless Congress continues to sit indefinitely after the Democratic convention.

Railroads at the New York World's Fair

The railroad exhibit at the New York World's Fair last year proved to be one of the most popular attractions of that great exposition. The best features of that presentation have been retained this season and a number of distinct improvements have been made, so that in its new dress it is making a still more decided impression. Edward Hungerford has supplied three new scenes for "Railroads on Parade," and with the orchestra out in front, new music and new costumes, it is going over strong. "Building the Railroad," the great mountain diorama, has likewise been changed in many respects and is much more attractively lighted. The large model railroad, which was called "Railroads at Work" last year, now goes under the title of "Railroads in Action." Its track mileage has been increased 25 per cent and it now includes 200 locomotives, as well as considerable other new special equipment. The extensive track exhibit parallels that of last year, and part of its equipment will be changed from time to time during the summer months. Visitors to the railroad exhibit are enthusiastic about the additions and improvements that have been made.

Railway Buying Up

The improvement in business on the railroads thus far this year has, as usual, been reflected in their increased purchases, according to figures recently published in the Railway Age. The total purchases for the first five months this year, including materials received from manufacturers, equipment ordered from manufacturers, and fuel, amounted to $396,303,000. This is greater than that for any corresponding period since 1930, except 1937, when these purchases amounted to 574,960,000. The figures for the first five months of this year are subject to revision, but are approximately correct. Specifically, the materials received from the manufacturers amounted to $249,064,000, the equipment ordered to $35,096,000 and fuel purchased to $112,143,000.

Railroads in Defense Program

The National Defense Commission appointed by President Roosevelt on May 28, has been assigned the task of speeding up national defense measures. As wars are conducted nowadays, industrial production is of utmost importance; indeed, it may be the decisive factor. Edward R. Stettinius, Jr., formerly chairman of the board of the United States Steel Corporation, heads up the section responsible for the supply of raw materials. W. S. Knudsen, former president of the General Motors Corporation, is responsible for industrial production. Ralph Budd, president of the Chicago, Burlington & Quincy, has the task of seeing that the materials are transported without delay. Mr. Stettinius has appointed W. A. Harriman, chairman of the board of the Union Pacific, to act as a liaison officer between the raw materials section and the transportation section. He has also appointed W. C. Bower, vice-president of the New York Central in charge of purchases and stores, to the position of purchasing agent for the raw materials section. Other members of the National Defense Commission are Sidney Hillman, president of the Amalgamated Clothing Workers of America, who will be concerned with problems of labor and employment; Chester C. Davis, a member of the board of governors of the Federal Reserve System, who will look after the farmers' interests; Harriet Elliott, dean of women at the University of North Carolina, who will study the effect of the defense measures on the consumers' interests, and Leon Henderson, a member of the Securities and Exchange Commission, who will be watchful of the effect of the production of war materials on our economy as a whole.

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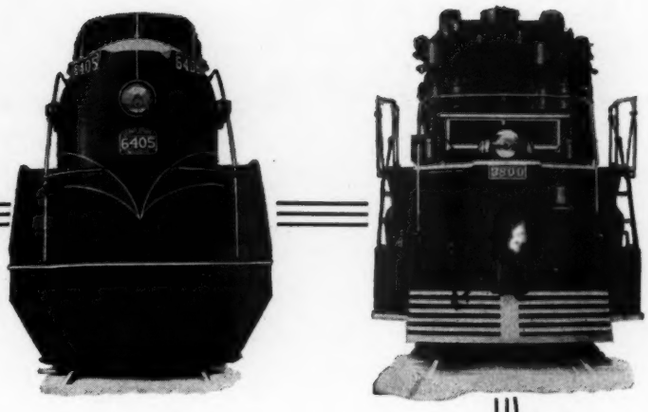

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LIMA LOCOMOTIVE WORKS INCORPORATED, LIMA, OHIO

A 19-unit train operated by the Chicago, Burlington & Quincy in connection with a recent convention of Kiwanians at Milwaukee, Wis.

NEWS

W. M. Barr Heads A. S. T. M.

At the annual meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 24-28, Dr. W. M. Barr, chief chemical and metallurgical engineer of the Union Pacific, was elected president of the Society for the ensuing year.

Burlington Operates 17 Stainless Steel Cars in Single Train

Seventeen stainless steel cars and a 4,000-hp. two-unit, stainless-steel Diesel-electric locomotive were used by the Chicago, Burlington & Quincy on June 16 to carry 500 Kiwanians from Chicago to Minneapolis, Minn., for their International convention in that city. According to the Burlington, this is the longest stainless-steel train ever operated. The train, which was operated as the second section of the Morning Twin Cities Zephyr, covered the 437 miles in seven hours. Ten of the cars comprising the train had just been delivered by the builder. The train was photographed while moving at 80 to 90 m.p.h.

Two Alco-G. E. Diesel-Electric Switchers for Stock

New Diesel-electric switchers in two sizes—660- and 1,000-hp.—based on new designs are being built for stock by the American Locomotive Company and the General Electric Company to assure quick deliveries.

Designed for an operating availability of at least 8,000 hours per year, the new units are each powered by a four-cycle Alco Diesel engine and G-E electric equipment. Better visibility and streamlining are attained by the underframe design which allows a depressed mounting of the Diesel engine, thus permitting a low narrow hood. The automatic series-parallel control installed in the switchers makes the full Diesel horsepower available for traction at all locomotive speeds up to 35 m.p.h.

One of the new Diesel-electrics is now on display at the railroad track exhibit at the New York World's Fair.

I. C. C. Authorizes Experimental Cars

The American Car and Foundry Company has been authorized by the Interstate Commerce Commission in a report by Commissioner Alldredge to construct 40 fusion-welded tank cars for service in the transportation of caustic soda solution.

The Monsanto Chemical Company and the American Car and Foundry Company have been authorized by the Interstate Commerce Commission to construct one tank car with riveted aluminum alloy tank for experimental service in the transportation of 95 per cent nitric acid. The commission's action was by Commissioner J. Monroe Johnson in another of the Special Series A orders in No. 3666.

The Union Tank Car Company has been authorized by the Interstate Commerce Commission to construct 100 fusion-welded tank cars for experimental service in the transportation of petroleum products.

Retirement Board Has New Publication

The Railroad Retirement Board has issued the first copy of its Monthly Review which will replace the Weekly Review which has been published for several months. In the foreword it is stated that the purpose of the publication is to provide current information concerning the operations under the Railroad Retirement and Railroad Unemployment Insurance Acts, primarily for employers and employees covered by those acts and for their associations and organizations.

It is further pointed out that the publication will contain monthly statistics of operation under each act, explanations of the regulations and rulings made under both acts, digests of the opinions of the general counsel concerning various legal questions arising under the acts, notifications of changes in the Board's administrative organization and key personnel, special articles covering the more important phases of the operation of railroad social insurance, and other material "relevant to a better understanding of the Board's tasks and activities."

Railroads Ready for Defense Emergency, Says Pelley

At a meeting of the member roads of the Association of American Railroads at Chicago on June 18 for the purpose of discussing the equipment and transportation situation, J. J. Pelley, president, Association of American Railroads, reiterated the fact that the railroads of the United States are ready to meet any transportation demands that will arise during the evolution of our defense program or from an increase in regular commercial traffic. Ralph Budd, president of the Chicago, Burlington & Quincy, and a member of the National Defense Committee, told the same meeting that railroad management will be permitted to do its share in the national rearmament program without interference from the federal government. "The belief in Washington now is," he said, "that the railroads under private ownership and operation can do their job more effectively than if there was direct control over them. The confidence shown in the railroads by the government calls for a recognition by the

(*Continued on next left-hand page*)

railroads of their own responsibility in co-operating in the defense program."

A survey submitted at the meeting showed that there were then in operation approximately 36,000 more serviceable freight cars than there were at the peak of business in October, 1939, and that by October 1 of this year there will be an increase of 148,000 serviceable freight cars over the October, 1939, figure. In October, 1939, the railroads handled a maximum of 860,000 loaded cars a week, with an average daily surplus of more than 60,000 cars.

It also showed that on June 1, 1940, the railroads had on order 15,039 new freight cars. In addition, they were ready to place orders for 3,425 more new freight cars, making a total of 18,464 cars. This is approximately twice the number on order a year ago. All these new cars, together with 13,000 other cars which are to be rebuilt this summer, will be in operation in advance of the usual fall increase in business. In addition to new and rebuilt cars, the repair program undertaken by the railroads will add not less than 80,674 serviceable cars to the supply available for meeting transportation demands this fall.

With the repair of such equipment and the addition of the new cars now on order it is estimated that the railroads will have by October 1, 1940, 147,907 more serviceable freight cars than were available at the same time last year. Of the total number of freight cars which will be in service by October 1 of this year, approximately 210,000 will be less than five years old.

Equipment Depreciation Orders

EQUIPMENT depreciation rates for thirteen railroads, including the Reading, the Detroit, Toledo & Ironton, and the Wheeling and Lake Erie, have been prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15100, Depreciation Charges of Steam Railroad Companies. The composite percentages for all equipment, which are not prescribed rates, range from 2.76 per cent for the Reading to 5.12 for the High Point, Thomasville & Denton, the higher composite figure of 10 per cent for the Union of Oregon being merely the prescribed rate for that road's locomotives other than steam, the only class of equipment covered by the sub-order applying to the Union.

The Reading's composite percentage of 2.76 is derived from prescribed rates as follows: Steam locomotives, 2.79 per cent; other locomotives, 3.84 per cent; freight-train cars—owned, 2.76 per cent, leased 2.57 per cent; passenger-train cars, 2.54 per cent; floating equipment, 2.48 per cent; work equipment, 4.6 per cent; miscellaneous equipment—owned, 10.11 per cent, leased, 5.29 per cent. The composite percentage for the D. T. & I. is 4.07, derived from prescribed rates as follows: Steam locomotives—new, 3.04 per cent, secondhand and rebuilt, 6.03 per cent; freight-train cars—new, 3.57 per cent, secondhand and rebuilt, 4.13 per cent; passenger-train cars—secondhand and rebuilt, 4.96 per cent; work equipment, 3.49 per cent; miscellaneous equipment, 17.12 per cent.

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the June Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Locos.	Builder
Atchison, Topeka & Santa Fe	2	5,400-hp. Diesel-elec.	Electro-Motive Corp.
Chicago, Burlington & Quincy	2	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	7	600-hp. Diesel-elec.	Electro-Motive Corp.
Detroit, Toledo & Ironton	4	2-8-2	Lima Loco. Wks.
E. de F. de Goyaz (Brazil)	1	4-6-0	Baldwin Loco. Wks.
Guayaquil & Quito (Ecuador)	2	2-8-0	Baldwin Loco. Wks.
Missouri Pacific	1	1,000-hp. Diesel-elec.	}
	1	600-hp. Diesel-elec.	} Electro-Motive Corp.
	2	600-hp. Diesel-elec.	American Loco. Co.
	2	600-hp. Diesel-elec.	Baldwin Loco. Wks.
	2	44-ton Diesel-elec.	General Elec. Co.
	1	44-ton Diesel-elec.	H. K. Porter Co.
	1	44-ton Diesel-elec.	Davenport-Besler Corp.
	1	44-ton Diesel-elec.	Whitcomb Loco. Wks.
Mitsui & Co.	6	2-8-2	American Loco. Co.
United Fruit Co.	4	2-8-2	Baldwin Loco. Wks.
Western Maryland	12	4-6-6-4	Baldwin Loco. Wks.

LOCOMOTIVE INQUIRIES

Atchison, Topeka & Santa Fe	10	4-8-4	.....
Southern Pacific	20	4-8-4	.....

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Baltimore & Ohio	100	70-ton hoppers	Company shops
Cambria & Indiana	200	50-ton coal hoppers	Bethlehem Steel Co.
Central of Georgia	15	70-ton hoppers	Pullman-Std. Car Mfg. Co.
Chesapeake & Ohio	300	50-ton box	American Car & Fdry. Co.
	200	50-ton box	Gen. Amer. Trans. Corp.
	200	50-ton box	Mt. Vernon Car Mfg. Co.
	200	50-ton box	Pullman-Std. Car Mfg. Co.
	100	50-ton box	Greenville Steel Car Co.
	50	Caboose	St. Louis Car Co.
	50	Caboose	Magor Car Co.
Denver & Rio Grande Western	500[1]	50-ton box	Pressed Steel Car Co.
Detroit, Toledo & Ironton	50	70-ton hoppers	Greenville Steel Car Co.
Donora Southern	30	70-ton gondola	Magor Car Corp.
Great Northern	500	50-ton box	Pressed Steel Car Co.
	500	50-ton box	Pullman-Std. Car Mfg. Co.
Gulf, Mobile & Northern	250	50-ton hoppers	Pullman-Std. Car Mfg. Co.
	1,000[2]	Box-car bodies	American Car & Fdry. Co.
Milwaukee, St. Paul & Sault Ste. Marie	400	40-ft.-6-in. box	}
	100	50-ton box	} Pullman-Std. Car Mfg. Co.
Missouri Pacific	200[3]	40-ton steel frame stock	American Car & Fdry. Co.
	30	70-ton hoppers	Mt. Vernon Car Mfg. Co.
Mobile & Ohio	250	Hoppers	Pullman-Std. Car Mfg. Co.
New York, Chicago & St. Louis	50	70-ton gondolas	}
	75	50-ton flat	} Bethlehem Steel Co.
	250	50-ton gondolas	Pullman-Std. Car Mfg. Co.
	200	50-ton gondolas	Gen. Amer. Transp. Corp.
	300	50-ton box	American Car & Fdry. Co.
Tennessee Coal Iron & R. R. Co.	10	70-ton gondolas	Pullman-Std. Car Mfg. Co.
Wabash	5	Hoppers	American Car & Fdry. Co.

FREIGHT-CAR INQUIRIES

Eastern Gas & Fuel Associates	50	50-ton triple hoppers	.....
Illinois Central	1,000	40-ton box	.....
	1,000	50-ton box	.....
	500	40-ton box	.....
	500	Automobile	.....
Missouri Pacific[4]	30	70-ton hoppers	.....
Southern Pacific	1,500	Box	.....
	500	Automobile	.....

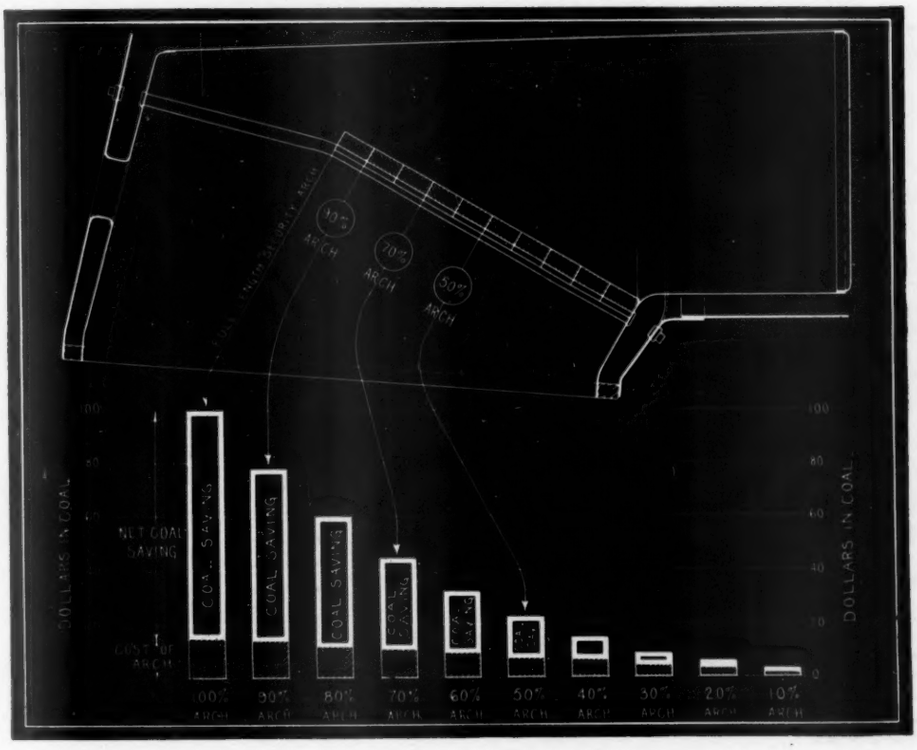
PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Missouri Pacific		Three-unit streamlined train[5]	.....

PASSENGER-CAR INQUIRIES

Seaboard Air Line	18	Coaches	.....
Southern Pacific	2	Bagg.-postal	}
	2	Baggage	}
	2	Artic. diner-kitchen-coffee shop (6 units)	} (First inquiry)
	2	Parlor-observation	}
	8	Chair	}
	2	Artic.-chair (4 units)	}
	9	Bagg.-postal	}
	2	Postal-storage	}
	3	Postal	}
	17	Baggage	} (Second inquiry)
	2	Artic. counter-diner-kitchen-dormitory (4 units)	}
	5	Dining	}
	7	Lounge	}
	50	Chair (Third inquiry)	.....

[1] Subject to approval of the court.
[2] The G. M. & N. will furnish the trucks for these cars. An order for 250 hopper cars of 50 tons' capacity was placed with the Pullman-Standard Car Manufacturing Company.
[3] One hundred for the Gulf Coast Lines; 100 for the International Great Northern.
[4] Authorized by the district court to ask for competitive bids.
[5] The 1000 hp. Diesel-electric locomotive to be built by the Electro-Motive Corporation and the two coaches by the St. Louis Car Company. The train will be operated between Memphis, Tenn., and Tallulah, La.



THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

LET THE ARCH HELP YOU SAVE

With the emphasis being placed on saving every railroad dollar, the locomotive Arch becomes increasingly important.

Regardless of the amount of traffic handled, the locomotive Arch saves enough fuel to pay for itself ten times over.

Be sure that every locomotive leaving the roundhouse has its Arch complete with not a single brick nor a single course missing.

In this way, you will get more work for each dollar of fuel expense. Skimping on Arch Brick results in a net loss to the railroad.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

AMERICAN ARCH CO.
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60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

The composite percentage for the Wheeling & Lake Erie is 3.62, derived from prescribed rates as follows: Steam locomotives, 3.53 per cent; freight-train cars, 3.65 per cent; work equipment, 3.61 per cent; miscellaneous equipment, 15.65 per cent.

President Approves Changes in Titles of Inspectors

PRESIDENT Roosevelt has approved an act to amend the locomotive inspection act of February 17, 1911, so that the titles of chief inspector and assistant chief inspectors of locomotive inspection are changed to director and assistant directors of locomotive inspection, respectively.

Baldwin Has New Dispensary at Eddystone

THE Baldwin Locomotive Works has opened a new dispensary with complete equipment for the treatment of injuries resulting from industrial accidents. The dispensary occupies a six-room suite covering 1,700 sq. ft. on the first floor of the office building at the company's Eddystone, Pa., plant. A full-time doctor and registered nurse are in attendance and the dispensary will remain open under the direction of a trained nurse whenever night shifts are employed in the plant.

A novel feature of the dispensary is a dental room where the employees, if they desire, may have dental work done, paying for the service at a moderate cost. All other facilities, including emergency dental work resulting from an accident, are available without charge.

Announcing the opening of the new facilities, Charles E. Brinley, president of the Baldwin Locomotive Works, called attention to the fact that Baldwin's accident frequency last year was 28 per cent lower than in 1938 on a man-hour basis and that the severity of accidents as measured by working days lost was reduced by more than 50 per cent. "We hope," he continued, "to lower still further the number of working days lost through accidents and sickness, thus helping both the employees and the company."

I. C. C. Members Receive New Assignments

THE Interstate Commerce Commission on June 4 announced the formulation of new assignments for its members, effective on that day. On the previous day, former Assistant Secretary of Commerce J. Monroe Johnson took his oath of office as a member of the commission, succeeding Marion M. Caskie who resigned on April 1.

Under the new assignments, Division 1—Administration, will consist of Chairman Eastman and Commissioners Porter and Lee, with Commissioner Aitchison acting as an additional member "with respect to matters connected with the admission, disbarment and suspension of practitioners before the commission under Rule I-B of the Rules of Practice." Division 2—Rates, Tariffs and Valuation, will consist of Commissioners Aitchison, Splawn and Alldredge; Division 3—Rates, Service and Safety, Commissioners Mahaffie, Alldredge and Johnson, "except that Commissioner Patterson shall serve in lieu of Commissioner Alldredge with respect to matters arising under Section 26(a)-(g), inclusive, of the Interstate Commerce Act, Railroad Retirement Act of 1937, Carriers Taxing Act of 1937, Railroad Unemployment Insurance Act, the Railway Labor Act, Safety Appliance Acts, Locomotive Inspection Act, Ash Pan Act, Block Signal Resolution of June 30, 1906, Sundry Civil Appropriation Act of May 27, 1908, and Medals of Honor Act." Division 4—Finance, will consist of Commissioners Porter, Mahaffie and Miller; and Division 5—Motor Carriers, Commissioners Lee, Rogers and Patterson.

W. G. Gray Becomes Assistant Mechanical Engineer, A. A. R.

W. G. GRAY, who was appointed assistant mechanical engineer, Association of American Railroads, mechanical division, effective May 1, graduated in 1926 from Penn State College with a B.S. degree in Industrial Engineering. In September of the same year he entered railway service as a special apprentice at the Packerton, Pa., shop of the Lehigh Valley, being transferred in September, 1928, to Sayre, Pa., shop as apprentice instructor, and in September, 1929, to the mechanical engineer's office, where he worked on various design problems and analyzed road test data for both cars and locomotives. He became car foreman at the Oak Island shop in August, 1930; night foreman in the train yard at Sayre in September, 1931; assistant general foreman, passenger-car shop at Sayre in November, 1931; general supervisor, freight-passenger repairs in April, 1932, and special engineer in the office of the superintendent of motive power in June, 1937. On January 1, 1939, Mr. Gray left the service of the Lehigh

W. G. Gray

Valley to become engineer freight-car design for the Union Pacific at Omaha, Neb., a position which he held until the time of his recent appointment as assistant to W. I. Cantley, mechanical engineer, A. A. R., mechanical division.

Equipment Purchasing and Modernization Programs

Chicago, Milwaukee, St. Paul & Pacific.—The Milwaukee plans an addition and alterations to its locomotive machine and boiler shop at South Minneapolis, Minn., and also replacement of the old transfer table at that point with a new electrically-operated two-rail type transfer table of 225

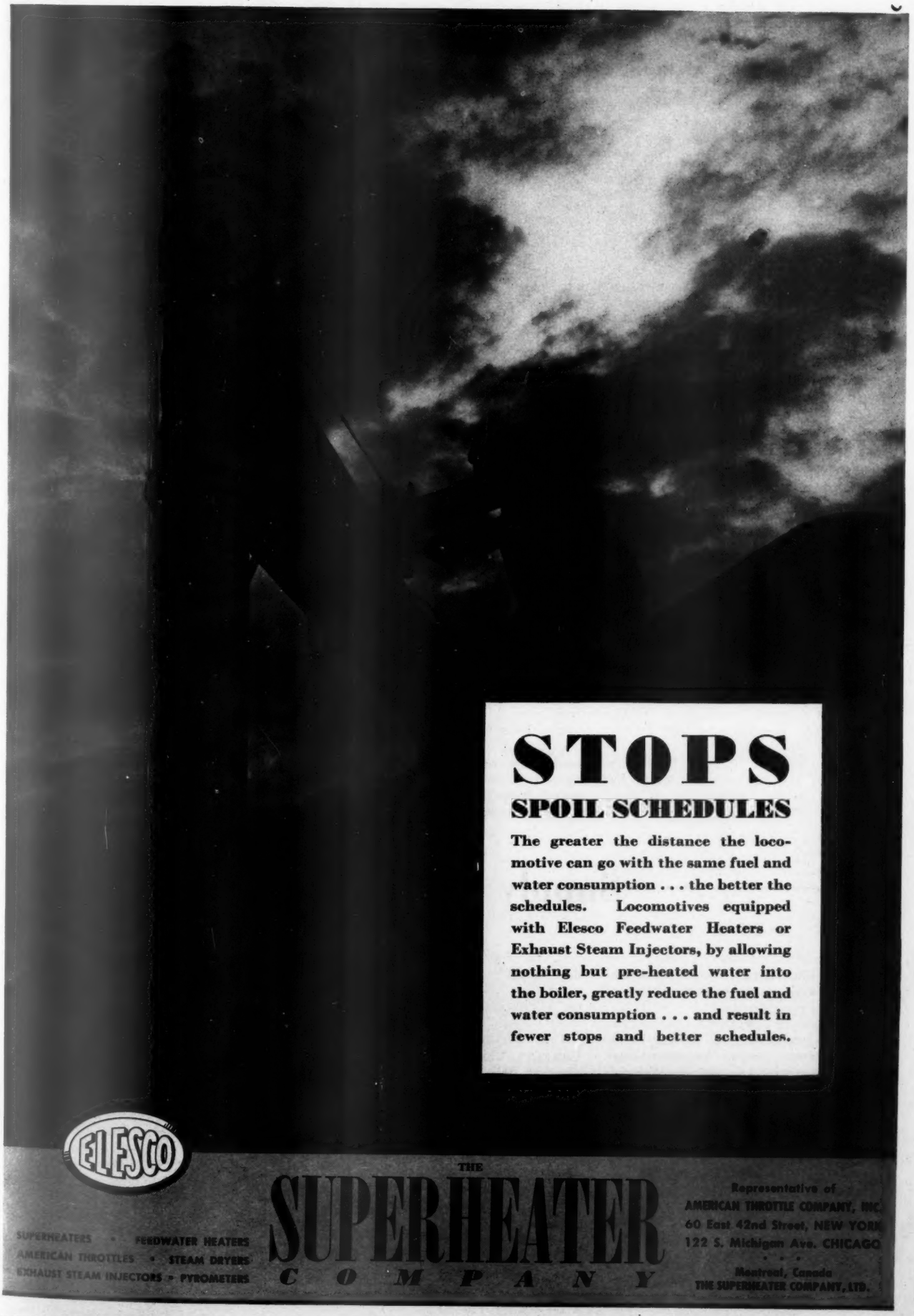
(*Continued on next left-hand page*)

* * *

Photo by Blakeslee-Lane

Interior of one of fourteen modern coaches recently placed in service by the Southern

The cars were modernized by the road in its own shops at a cost of approximately $275,000. They are air-conditioned and fitted, among other things, with reclining chairs, individual seat lighting, special baggage and parcel storage compartments and spacious lounges and smoking compartments


STOPS
SPOIL SCHEDULES
The greater the distance the locomotive can go with the same fuel and water consumption . . . the better the schedules. Locomotives equipped with Elesco Feedwater Heaters or Exhaust Steam Injectors, by allowing nothing but pre-heated water into the boiler, greatly reduce the fuel and water consumption . . . and result in fewer stops and better schedules.
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tons' capacity. The addition to the locomotive machine and boiler shop will be 16 ft. wide and 198 ft. long, constructed with steel framework; corrugated, galvanized iron insulated walls and roof; wood sash and rolling steel doors. The alterations will include the construction of a new concrete drop table pit 15 ft. by 43½ ft., and 16 ft. deep, the installation of a four-screw 80-ton electrically operated drop table, and the replacement of stone masonry engine pits with six new concrete pits. The pits will be of such design that it will be possible to jack up all classes of locomotives for repair work. In addition, one track in the boiler shop will be extended through the boiler shop to connect with a track in the enginehouse to provide a through track from the transfer table to the roundhouse turntable. The total estimated cost of the improvements is nearly $113,000.

Chicago, Rock Island & Pacific.—Approximately $82,000 will be spent for the electrification of the El Reno (Okla.) terminal and the construction of a new machine shop at that point. Included in the electrification work will be the installation of electric-driven air compressors and water pumps in place of steam-driven units. The new machine shop will be constructed as an annex to the enginehouse and will be a one-story steel, brick and concrete structure 80 ft. by 120 ft. Most of the equipment to be installed in the machine shop will be transferred from other points.

Denver & Rio Grande Western.—The D. & R. G. W. has asked the Interstate Commerce Commission for authority to assume liability for $1,522,299 of four per cent equipment trust certificates, maturing in 15 equal annual installments beginning September 1, 1941. The proceeds will be used as part payment for equipment costing $1,698,110 and consisting of 500 50-ton, 40½ ft. box cars.

Great Northern.—The Great Northern's improvement and equipment program for 1940 calls for the expenditure of about $21,000,000. The largest items on the program, already under way in the 10 states in which the road operates, are for equipment, roadbed maintenance and improvement. The company announced late in 1939 plans for the purchase of new, and the reconditioning of old, equipment but expenditures for these items are included in this year's budget. The road will acquire new, and recondition old, equipment this year at a cost of about $13,000,000. This includes the purchase just made of 2,000 modern box cars at a cost of $6,000,000, the reconstruction of 10 ore service locomotives and the general reconditioning of locomotives, freight and passenger cars. An expenditure of about $570,000 has been authorized for alterations and reconstruction of freight and passenger stations, enginehouses, elevators, water tanks and coaling stations at various points along the line.

Illinois Central.—The Reconstruction Finance Corporation has agreed to loan the Illinois Central $11,000,000 for the purchase of new equipment, the rolling stock to consist of 3,000 box cars, two or three Diesel-electric trains and six Diesel-electric passenger locomotives.

Missouri Pacific.—The Missouri Pacific has asked the Interstate Commerce Commission for authority to assume liability for $750,000 of equipment trust certificates, maturing in payments of $75,000 on August 1 of each year from 1941 to 1950, inclusive. The proceeds, together with a cash payment of $190,000, will be used to purchase equipment costing a total of $940,000 and consisting of one 125-ton, 1,000-h.p. Diesel-electric switching locomotive; one 100-ton, 600-h.p. Diesel-electric switching locomotive; four 100-ton, 660-h.p. Diesel-electric switching locomotives; five 44-ton Diesel-electric switching locomotives; one 1,000-h.p. Diesel-electric passenger locomotive; one streamline train consisting of one coach-mail car and one coach-grille car of lightweight low-alloy high-tensile steel and 30 70-ton covered cement hopper cars.

The Missouri Pacific is repairing 214 box cars, lining 60 coal cars with galvanized sheet iron and converting 7 dump cars into container cars in its own shops.

Norfolk & Western.—The Norfolk & Western is proceeding with an improvement program amounting to approximately $8,000,000. This program includes the purchase of 25,000 tons of 131-lb. steel rail and fastenings; 1,000 new 55-ton hopper coal cars; 500, 40-ft. box cars, and 50, 50-ft. box cars.

Pennsylvania.—The directors of the Pennsylvania have authorized the placing of orders for new equipment, to cost approximately $10,000,000, to include the following:

1,900 general purpose "mill-type" gondola cars, 52½ ft. long, 70-ton capacity.
200 "mill type" gondola cars, 65 ft. long, 70-ton capacity.
225 covered, weather-proof hopper cars for bulk transportation of cement, etc.
200 all-steel cabooses, with insulated bodies.
20 heavy-duty flat cars of extra large carrying capacity.
25 tenders of 21,000-gal. capacity.

In addition, the board has authorized the construction of two high-speed coal-burning steam passenger locomotives of a new design, utilizing four cylinders to turn eight driving wheels; also eight ultra-modern-type passenger cars for use in the new Chicago-Miami luxury coach train service to be inaugurated next fall.

Western Maryland.—The Western Maryland has asked the Interstate Commerce Commission for authority to assume liability for $1,890,000 of two per cent equipment trust certificates, maturing in 10 equal annual installments of $189,000 each on July 15 in each of the years from 1941 to 1950, inclusive. The proceeds will represent 79.92 per cent of the purchase price of equipment costing $2,364,720 and consisting of 12 new standard gauge single expansion articulated 4-6-6-4 simple mallet steam locomotives.

Virginian.—The Virginian has received prices for materials to be used in the construction of 500 hopper cars of 50 tons' capacity; these cars may be built in its own shops.

Supply Trade Notes

ROBERT L. CLAUSE, vice-president of the Pittsburgh Plate Glass Company, has been promoted to the newly created position of executive vice-president.

◆

MANNING, MAXWELL & MOORE, INC.—The name of the Ashcroft American Gauge Division has been changed to Ashcroft Gauge Division.

◆

ARTHUR T. COX has been appointed sales manager of the Bettendorf Company, with headquarters at Bettendorf, Ia. Heretofore Mr. Cox has been district manager of the Lincoln Electric Company.

◆

FRED L LAWRENCE has been appointed Detroit district manager, with office in the General Motors building, Detroit, Mich., for the Copperweld Steel Company, Glassport, Pa.

E. H. ANCHORS, branch manager for the Air Reduction Sales Company at Atlanta, Ga., has been appointed manager of the Oklahoma City, Okla., district.

◆

THE BRAKE EQUIPMENT & SUPPLY COMPANY, Chicago, will move into a new plant at 7001 West Sixty-Sixth Place in the Clearing industrial district on June 1. The new plant contains 25,000 sq. ft. of floor space.

◆

W. C. MORGENSTERN has been appointed assistant chief engineer of the Copperweld Steel Company, with headquarters in the company's new plant at Warren, Ohio.

◆

MARSHALL D. RAYMOND, district sales manager of the American Locomotive Company, New York, with headquarters at San Francisco, Cal., has been transferred to Cleveland, Ohio, and has been succeeded by Stephen G. Harwood, formerly representative at Chicago.

◆

THE RYAN DEVICES COMPANY, Chicago, has moved its offices to 332 South Michigan boulevard.

◆

ALLEN W. MORTON, vice-president of the Koppers Company, in charge of the American Hammered Piston Ring Division, has been granted a leave of absence to serve as a full-time special assistant to Edward R. Stettinius, Jr., chairman of the Advisory Commission to the Council of National Defense.

◆

TRUMAN B. BROWN, who has been employed in the development and sales promotional activities of Ludlite for the Allegheny Ludlum Steel Corporation, Pitts-

burgh, Pa., has been promoted to manager of Ludlite sales, with headquarters at Watervliet, N. Y.

◆

C. R. MITCHELL, JR., has been appointed assistant district manager of sales for the New York district office of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa.

◆

MAX F. BECKER has been appointed vice-president in charge of sales representatives of the Whiting Corporation, Harvey, Ill. After his graduation from Purdue University in June, 1920, he began

M. F. Becker

work in the pulverizer division of the Whiting Corporation. Mr. Becker for several years served in various departments and then became manager of the Whiting foundry equipment division. In 1939 he was appointed sales manager of the industrial division, which position he held at the time of his appointment as vice-president.

◆

ELASTIC STOP NUT CORPORATION has moved its general office from Elizabeth, N. J., to its new plant at 2332 Vauxhall Road, Union, N. J., a suburb of Newark. The corporation's Houston, Tex., office has been moved to The Merchants and Manufacturers building.

◆

J. R. KUMER, JR., assistant manager of sales, stainless bar and wire products, for the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa., has been appointed manager of stainless bar and wire sales succeeding C. B. Boyne. Louis F. Lippert of the sales division has been appointed manager of Pluramelt sales with headquarters at Pittsburgh.

◆

JOHN W. ALDEN has been appointed mill metallurgist for the steel and tube division of the Timken Roller Bearing Company. Mr. Alden was employed as metallurgist for the United Steel Company, the Central Alloy Steel Corporation, and Republic Steel Corporation before becoming a member of the staff of the Timken Roller Bearing Co.

◆

THE AIR REDUCTION COMPANY has completed the construction of an acetylene plant at West Berkeley, Cal. The new plant is located just a short distance from the site of the old plant, and includes all modern equipment for the manufacture of acetylene and the filling, compressing and the handling of cylinders.

◆

C. R. HALL, assistant purchasing agent since 1936 of the Air Reduction Company, has been appointed purchasing agent of the company and its subsidiary and affiliated concerns, succeeding H. M. Daggett, retired.

◆

THE KOPPERS COAL COMPANY on June 1 moved its Philadelphia, Pa., district office from the Packard building to 1458 Broad Street Station building, and The Wood Preserving Corporation at that address has moved its office to the same suite. The Koppers Coal Company is an affiliate and The Wood Preserving Corporation is a subsidiary of the Koppers Company.

◆

GLOBE STEEL TUBES COMPANY.—*Frank T. Murphy* has been appointed manager of sales of the St. Louis district. *Neal E. Boeckler* has been appointed assistant manager of sales of the St. Louis district. *Gilbert H. Krohn,* manager of sales of the Wisconsin district, has been transferred to Chicago as sales agent, and *Charles A. Schroeder* has been appointed manager of sales of the Wisconsin district, with headquarters at Milwaukee, Wis.

◆

UNITED STATES STEEL CORPORATION.—*Edward R. Stettinius, Jr.,* has resigned as chairman of the board of directors and as a member of the board of directors and finance committee of the United States Steel Corporation in order to serve as a member of the recently appointed National Defense Commission. *Irving S. Olds* has been elected chairman of the board of directors to succeed Mr. Stettinius. *Irving Sands Olds,* who has been a member of

Irving S. Olds

the finance committee of the Steel Corporation since October 27, 1936, was born at Erie, Pa., on January 22, 1887. He was a graduate from Erie High School in 1903, from Yale College in 1907, and Harvard Law School in 1910. He was admitted to the bar in Pennsylvania in 1910 and in New York in 1912. Mr. Olds was secretary to Justice Holmes, of the United States Supreme Court, 1910-1911, becoming connected with White & Case, a New York legal firm, in August, 1911, and admitted as a partner January 1, 1917. During 1917-1919 he served as counsel for the purchasing department of the British War Mission to the United States, and in 1918 was a special assistant in the U. S. War Department. Since 1919, Mr. Olds, as a member of the firm of White & Case, has engaged in legal work related to matters of organization and administration of corporate business enterprises.

◆

GEORGE D. CASGRAIN, vice-president of the Griffin Wheel Company, Chicago, retired from active service on July 1, and has been elected vice-president of the Marquette Railway Supply Company, Chicago. Mr. Casgrain was born in Milwaukee, Wis.,

George D. Casgrain

and was employed by the Griffin Wheel Company for 40 years. His activities have been devoted to sales matters in addition to which he has had supervision over all purchases since 1932. From 1890 to 1895, he was employed by the Fitzsimmons & Connell Company, contractors and timber dealers, and from 1895 to 1900, he worked in the contract department of the Chicago Telephone Company. In January of the latter year, Mr. Casgrain resigned to become associated with the Griffin Wheel Company.

Obituary

WALTER C. DOERING, vice-president of the American Steel Foundries, Chicago, at St. Louis, Mo., died in that city on June 20. For a number of years Mr. Doering was vice-president of the Bradford Corporation, and in 1930 resigned to become vice-president of the American Steel Foundries at St. Louis.

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GEORGE LEWIS BOURNE, chairman of the board of The Superheater Company, who died on May 25 at his home in Larchmont, N. Y., at the age of 67, was born in London, Eng., in 1874. After a period of preparatory school study at Rugby, he emigrated to Canada where he was employed by the Hudson's Bay Company and the Canadian Pacific. In 1893, Mr. Bourne

(*Continued on second left-hand page*)


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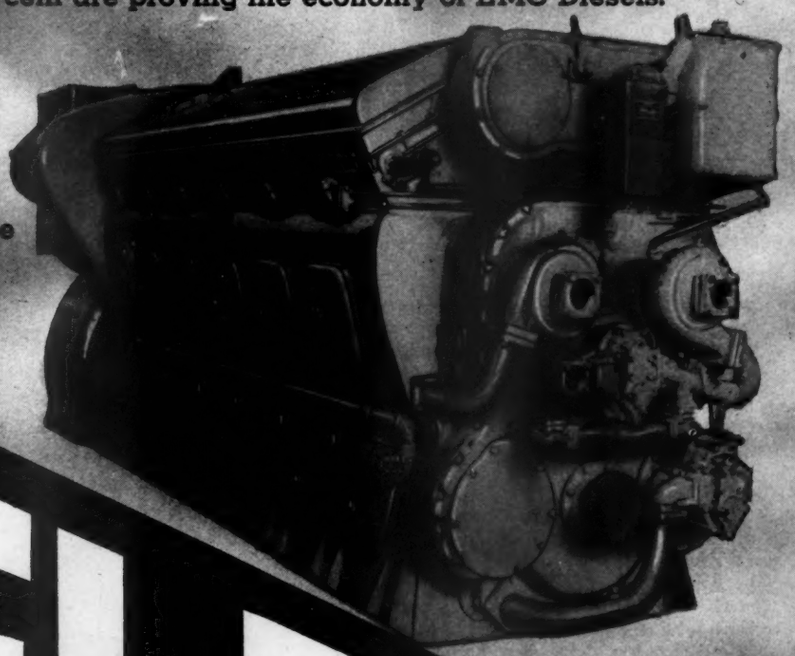

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came to the United States and for the next decade held various jobs, chiefly as fireman and locomotive engineer, on a number of western roads, including the Northern Pacific and the Chicago Great Western. On the latter he served for a time under Walter P. Chrysler, the automobile manufacturer, then master mechanic at Oelwein, Ia. Leaving railroad service, Mr. Bourne for a short time taught air-brake practice at the International Correspondence Schools. Scranton, Pa., after which he entered the railway supply field as a salesman, including service as vice-president of the Railway Materials Company, Chicago, between 1904 and 1910. During this period, Mr. Bourne had occasion to frequent most of the railroad shops in the country while selling such products as the Ferguson oil furnace and made an extensive study of motive-power problems. At this time he became interested in the design and manufacture of superheaters for locomotives which were being developed by the German Dr. Wilhelm Schmidt, Messrs. Vaughan and Horsey in Canada and others. In 1910, he joined S. G. Allen and the late J. S. Coffin in incorporating the Locomotive Superheater Company which took over scattered patents for superheating equipment and established manufacture on a large scale. He himself became vice-president, and in 1915, president. In 1916, he joined with G. M. Basford, Messrs. Allen and Coffin and others in forming the Locomotive Feed Water Heater Company, which The Superheater Company later absorbed. In 1932, Mr. Bourne was elected chairman of the board of The Superheater Company and was succeeded as president by Frederic A. Schaff. The following year, Superheater purchased a controlling interest in the International Combustion Engineering Corporation and affiliates, designers and manufacturers of a complete line of boilers and fuel-burning and related equipment, and The Air Preheater Corporation. Mr. Bourne became chairman of the re-organized Combustion Engineering Company, Inc. Mr. Bourne was a member of a large number of social and professional organizations, including the Western Railway, New York Railroad and Central Railway Clubs, the Newcomen

George L. Bourne

Society and the American Society of Mechanical Engineers.

Personal Mention

General

A. R. RUITER, assistant to the chief operating officer of the Chicago, Rock Island & Pacific, at Chicago, has been appointed superintendent of motive power of the First Mechanical district, with the same headquarters, succeeding G. P. Trachta.

WALTER BOHNSTENGEL, assistant engineer of tests on the Atchison, Topeka & Santa Fe, has been promoted to engineer of tests for the system, with headquarters as before at Topeka, Kan., succeeding to a portion of the duties of E. E. Chapman, mechanical assistant at Chicago, who has been serving also as engineer of tests.

GERALD P. TRACHTA, superintendent of motive power on the Chicago, Rock Island & Pacific at Chicago, has been promoted to assistant chief operating officer-mechanical, a newly created position, with the same headquarters and with jurisdiction over the mechanical department and all matters pertaining thereto. Mr. Trachta was born at Schuyler, Neb., on October 5, 1883, and entered railway service on December 19, 1901, as an enginehouse sweeper on the Chicago, Burlington & Quincy at Sheridan, Wyo., later becoming machinist helper and machinist. He entered engine service on March 10, 1903, as a locomotive fireman, being advanced to locomotive engineer on October 5, 1905, and to road foreman of engines on the Sheridan division on October 1, 1910. Seven years later he was promoted to the position of master mechanic on the Casper division, resigning on December 1, 1919, to become road foreman of engines on the Arizona Eastern (now part of the Southern Pacific), at Phoenix, Ariz. On March 1, 1923, Mr. Trachta returned to the Burlington as enginehouse foreman at Wymore, Neb., being promoted to general foreman at Kansas City, Mo., on August 1, 1923, and to master mechanic at Omaha, Neb., on August 1, 1925. Subsequently he was transferred to Galesburg, Ill., and thence to St. Joseph, Mo. On March 1, 1937, he was appointed district

Gerald P. Trachta

superintendent of motive power on the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., and in the latter part of 1938, was transferred to Chicago.

Master Mechanics and Road Foreman

G. M. LAWLER, who has been appointed division master mechanic of the Atchison, Topeka & Santa Fe at LaJunta, Colo., with jurisdiction over the enginehouse, locomotive and car departments, was born on July 12, 1888, at Albuquerque, N. M. He entered the service of the Santa Fe on March 1, 1905, as a machinist apprentice at Albuquerque. He became a machinist on May 10, 1909; gang foreman on November 24, 1910, and enginehouse foreman on February 20, 1912. He was transferred to Belen, N. M., as division foreman on November 1, 1915; to Raton, N. M., as general enginehouse foreman on January 11, 1917; to LaJunta as master mechanic, River Division, on November 1, 1920, and to Dodge City, Kan., as master mechanic on April 1, 1930. He became master mechanic of the Colorado & Western, with jurisdiction over the shop and car departments, on May 15, 1940.

C. T. FORSTER, general foreman of the Chicago & Western Indiana, has been appointed master mechanic, with headquarters as before at Chicago.

GEORGE SANDERS, general foreman, mechanical department of the Union Railroad, has been appointed master mechanic, with headquarters at East Pittsburgh, Pa.

JACOB UHRIG has been appointed master mechanic in charge of the locomotive and car departments of the Belt Railway Company of Chicago, succeeding P. Baker.

P. D. HAWKINS, assistant district fuel supervisor of the Erie at Marion, Ohio, has been appointed road foreman of engines of the Mahoning division with headquarters at Cleveland, Ohio.

CHARLES ALEXANDER WILSON, who has been appointed master mechanic of the middle division of the Pennsylvania, with headquarters at East Altoona, Pa., as noted in the June issue of the *Railway Mechanical Engineer*, was born on September 29,

1885, at North East, Md. He attended Perryville Public School; Jacob Tome Institute, Port Deposit, Md., and Drexel Institute. He became employed as a machinist apprentice in the Maryland division shops of the Pennsylvania at Wilmington, Del., on June 8, 1903. Upon the completion of his apprenticeship he served as a machinist until 1909; as a gang foreman, electrical department, until 1911; as foreman, electrical department, until 1917; as electrical supervisor, W. J. & S. R. R., until 1918; as assistant master mechanic, W. J. & S. R. R., until 1923; and assistant master mechanic of the Trenton

C. A. Wilson

division of the Pennsylvania, until 1925. From 1925 to 1929, Mr. Wilson was master mechanic of the Tyrone and Cresson division; from 1929 to 1933, master mechanic of the Atlantic division, and from 1933 to 1937, master mechanic of the Pennsylvania & Reading Seashore Line. He became master mechanic of the Williamsport division of the Pennsylvania, on April 16, 1937.

HAROLD C. WRIGHT, who has been appointed master mechanic of the Pennsylvania at Renovo, Pa., as announced in the June issue, was born on September 18, 1894, at Altoona, Pa. He attended Pennsylvania State College and received his B.S. degree in mechanical engineering with the class of 1919. He entered the service of the Pennsylvania as a store attendant on June 12, 1911, and was subsequently employed as clerk, December 12, 1913; store attendant, June 24, 1916; shop hand, June 6, 1917; special apprentice, July 1, 1919; inspector motive power, September 12, 1921; gang foreman, September 16, 1924; acting assistant foreman, April 17, 1926; gang foreman, April 24, 1926; foreman enginehouse, March 1, 1927; assistant foreman enginehouse, June 16, 1928; assistant master mechanic, Western Pennsylvania division, May 24, 1935; assistant engineer motive power, office general superintendent motive power, Chicago, April 16, 1937; foreman enginehouse and car shop, June 16, 1938; assistant master mechanic, Philadelphia division, July 1, 1939, and master mechanic, Altoona, May 1, 1940.

Car Department

WILLIAM H. TAYLOR, general car foreman of the Atchison, Topeka & Santa Fe at Clovis, N. M., retired on June 1.

C. L. PARNABY, gang foreman at the Lakeland shop of the Atlantic Coast Line, has been appointed assistant car foreman at Waycross, Ga., succeeding H. G. Moore.

H. G. MOORE, assistant car foreman of the Atlantic Coast Line at Waycross, Ga., has become foreman of the car department at Jacksonville, Fla.

F. J. SWANSON, general car foreman on the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis., has been appointed general car department supervisor, with headquarters at Chicago, succeeding William Snell, who retired on May 29.

Shop and Enginehouse

M. T. NAIVE, assistant night boiler foreman at the Radnor (Tenn.) enginehouse of the Louisville & Nashville, has been promoted to the position of boiler foreman, succeeding Stephen Holt, retired.

ALBERT H. BAIR, pipefitter foreman on the Union Railroad at East Pittsburgh, Pa., has been promoted to the position of general foreman, mechanical department.

J. H. ARMSTRONG, general foreman of the locomotive shop of the Atchison, Topeka & Santa Fe, at Topeka, Kan., has been appointed superintendent of shops, with the same headquarters, succeeding Howard H. Stephens, who has retired.

L. A. HARTLEY has been appointed supervisor of apprentices of the Erie, with headquarters at Cleveland, Ohio, succeeding C. P. Brooks.

Obituary

GEORGE GIBBS, consulting engineer of the Pennsylvania and chief engineer of electric traction of the Long Island, with headquarters at New York, died on May 19.

CHARLES J. WYMER, who retired on July 1, 1938, as superintendent of the car department of the Chicago & Eastern Illinois, with headquarters at Danville, Ill., died at Danville on June 16, after several months' illness following a light stroke. Mr. Wymer entered railroad service in 1891 with the Atchison, Topeka & Santa Fe. He later became connected with the car inspecting department of the Chicago & Eastern Illinois, resigning as general car inspector in 1912. He was then appointed general car foreman on the Belt Railroad of Chicago. In May, 1916, he was appointed sales representative at the Chicago office of the Grip Nut Company and in September, 1919, he returned to the C. & E. I. as superintendent of the car department, with headquarters at Danville. Mr. Wymer served as president of the Master Car Builders' and Supervisors' Association in 1929-30, and as second vice-president of the Western Railway Club, Chicago, in 1932-33.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

ENDURO STEELS.—Republic Steel Corporation, Cleveland, Ohio. Four illustrated booklets descriptive, respectively, of corrosion and heat-resisting steels, Types HCN, NC-3 and HC; stainless steel, Types AA, AA-FM, S-1, and FC; stainless and heat-resisting steels, and stainless steel, 18-8 types.

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WORTHINGTON CENTENARY.—Worthington Pump and Machinery Corporation, Harrison, N. J. An 80-page illustrated chronological story of the development and growth of the company 1840-1940.

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SHAPERS.—The Cincinnati Shaper Co., Cincinnati, Ohio. Twenty-seven page catalogue N-1, covering power rapid traverse, universal, utility and high-speed Cincinnati shapers, with details of construction.

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LANDIS EQUIPMENT.—Landis Machine Company, Waynesboro, Pa. Folder descriptive of Landis thread-cutting die heads, thread-cutting machines and collapsible taps.

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ALKALINE CLEANING.—Pennsalt Cleaner Division, Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia, Pa. Illustrated, eight-page folder on application of alkaline cleaning to various industries, including the cleaning of floors, walls, machines, locomotives, etc.

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NICKEL ALLOYS. — The International Nickel Company, Inc., 67 Wall street, New York. "Seven Minutes with Seven Metals," a pocket size booklet on uses and properties of nickel, monel Inconel, and associated alloys in both mill and clad forms.

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ELECTRODES.—Wilson Welder & Metals Company, Inc., New York. "Wilson Arc-Welding Electrodes," a 24-page guide for making proper selections of electrodes for all kinds of welding work. Describes physical properties of the electrodes and suggests proper application and welding procedure.

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SPUN HEADS FOR BOILERS, TANKS, ETC.—Lukens Steel Company, 308 Lukens building, Coatesville, Pa. "Lukens Flanging and Pressing," a 132-page wire-bound manual for the equipment designer and fabricator. Gives essential data for flanged only heads, flanged and dished heads, elliptical dished heads, flanged and reverse dished heads, etc. Engineering data.

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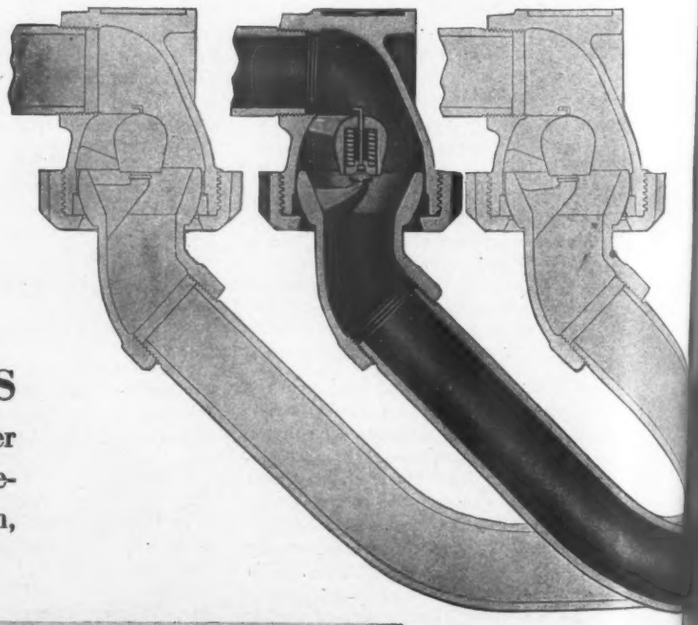

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